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ABSTRACT

The decade of the sixties saw the appearance of more formal curriculum development efforts in industrial arts than had occurred in its total prior history as a school subject. This paper seeks to explore, analyze, and compare these curriculum development efforts and to suggest priorities for future development, dissemination, and research activities. The programs discussed are grouped according to those based upon either industry or technology, those centered around the individual projects with a career development or occupational emphasis, and those characterized by an evolutionary approach. Although the literature reveals a widespread concern and involvement in an effort to improve the industrial arts program, there is still no instance where an innovative program has been implemented across all grade levels. Nor has there been much coordination with programs in other school subjects. Materials presently available vary from philosophical guidelines for adaptation by the teacher, to highly specific text materials and laboratory manuals, available commercially. Problem areas of research, development, and dissemination are identified by the author. (GEB)

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review and evaluation of

CURRICULUM DEVELOPMENT IN INDUSTRIAL ARTS EDUCATION

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REVIEW AND EVALUATION OF CURRICULUM DEVELOPMENT IN INDUSTRIAL ARTS EDUCATION

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PREFACE

Changes in education have accelerated throughout the last decade, and the changes within the development of industrial arts curriculum have been no exception.

This *Review and Evaluation of Curriculum Development in Industrial Arts Education* approaches the situation from the viewpoint of industry and technology. It was prepared especially for utilization by industrial arts curriculum specialists, state supervisors, researchers and teacher educators.

The extensive bibliography includes, for the most part, recent references to fully reflect the numerous changes within the past decade.

The profession is indebted to Daniel L. Householder, Purdue University, for his scholarship in the preparation of this report. Recognition is also due Ralph Bohn, San Jose State College, and Willis Ray, The Ohio State University, for their critical review of the manuscript prior to final revision and publication. J. David McCracken, information specialist at The Center, coordinated the publication's development.

Robert E. Taylor
Director
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and Technical Education

INTRODUCTION

As the visible program of the school, the curriculum represents the point-of-view of the educator brought to fruition in practice as teachers and learners interact within the educational environment. In recent years, there has been an increasing awareness of the need for change in the industrial arts curriculum. Like other subject areas in the total school program, industrial arts had fallen out of step with the times. The dissonance between recognized educational need and the actual activities in the classrooms and laboratories resulted in an imposing array of curriculum development efforts in many of the school subjects, including industrial arts. The decade of the sixties saw the appearance of more formal curriculum development efforts in industrial arts than had occurred in its total prior history as a school subject.

This paper seeks to explore, analyze, and compare these curriculum development efforts and to suggest priorities for future development, dissemination, and research activities. Since the paper is written primarily for curriculum specialists, state supervisors, researchers, and teacher educators in industrial arts education, it assumes basic familiarity with the field, its terminology, and its issues.

The primary emphasis in the review is upon the literature which has appeared since 1960. In some instances, unpublished material was cited to provide an effective exposition of a particular curriculum development effort. The primary review, however, includes a representative sample of relevant dissertations, selected state curriculum guides, journal articles, published addresses, instructional materials, and reports of the respective curriculum projects.

Appreciation is expressed to the many curriculum researchers who responded to inquiries, provided materials, and permitted interviews in the preparation of this review. A special note of thanks to Wesley E. Budke, Information Specialist, The Center for Vocational and Technical Education, who supplied computer searches of items listed in *Current Index to Journals in Education* (CIJE), *Abstracts of Research and Related Materials in Vocational and Technical Education* (ARM), and *Abstracts of Instructional Materials in Vocational and Technical Education* (AIM). The wealth of materials identified and collected cannot possibly be presented effectively in this short review; interested readers will want to explore in more detail many of the items listed in the bibliography.

Sincere gratitude is expressed to Robert E. Taylor, Director, and J. David McCracken, Information Specialist, of The Center for Vocational and Technical Education for encouraging the preparation of this paper.

Daniel L. Householder

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REVIEW AND EVALUATION OF CURRICULUM DEVELOPMENT IN INDUSTRIAL ARTS EDUCATION

PROBLEM DEFINITION

This paper attempts to review industrial arts curriculum development efforts, particularly those which have evolved during the past decade. The primary methodology is an analysis of the body of curriculum literature in industrial arts education. The analysis seeks to identify commonalities and trends which are apparent in the literature; it also attempts to point out ideological disparities and logical inconsistencies where they may appear to be obstacles to curriculum reform. The relative merits, advantages, and obvious shortcomings of available approaches are explored and an attempt is made to suggest promising areas for future development. As an outgrowth of the review, recommendations are made for priorities for future curriculum research and development efforts. Suggestions are also offered for improved dissemination of information relative to industrial arts curriculum innovations.

The lack of professional agreement upon an exact definition of the industrial arts curriculum makes it difficult to specify exact parameters for this review. Contemporary curriculum development efforts have substantially blurred the traditional boundaries of industrial arts, extending them toward and into the realms of occupational preparation, reaching into such general education disciplines as economics, broadening the range of content considered to be appropriate for industrial arts, and extending the scope of industrial arts education by providing more sophisticated content to younger learners.

For the purposes of this review, it seemed best to include those efforts which have evolved from traditional industrial arts programs and those efforts which seem to be closely related to industrial arts-type activities. This is not a proposed definition for the instructional areas; it is an attempt to compare curriculum development efforts which seem to have similar goals, which seek to serve similar clienteles, and which have at least a measure of outward similarity, especially to the layman. For the purposes of this review, it has seemed advisable to set aside the basic philosophical questions concerning the general education and occupational roles of industrial arts in order to concentrate upon the work that has been done, under whatever auspices. Consequently, a diverse array of developmental projects are examined and compared in terms of content and activities, with relatively little emphasis upon the specific objectives advocated for the instructional programs.

While many curriculum specialists equate the term, "curriculum," with the total school program, industrial arts curriculum researchers, like most subject matter specialists, have considered their work to be "curriculum development" even though it dealt with only one subject area, and was usually limited to a very few grade levels. The problem is also complicated by the fact that the literature abounds in articles on the improvement of various phases of instruction in the traditional industrial arts subjects, from new plastics projects and processes to variations on ancient teaching aids. The basic review is restricted to those efforts involving the development of at least one course, with precedence given to those projects pur-

porting to provide a sequence of courses or a complete industrial arts program. The review excludes all proposals which did not propose to modify or create at least a major unit in an industrial arts course.

At the time of this writing (mid-1971), most of the "competing" curriculum projects in industrial arts education are no longer funded. Many of them are in a state which could be considered suspended animation; some have gone through the past decade as a gleam in their proponents' eyes but with few tangible results, while a substantial body of curriculum materials has been put together and comprehensive field tests have been conducted on still others. This seems to be an appropriate time for a reassessment of the present situation, an evaluation of direction and speed of the current course, and an analysis of likely or needed designs and developments in the industrial arts curriculum. These considerations therefore serve as goals for this review.

HISTORICAL DEVELOPMENT

No one knows precisely how early man first came to teach his offspring to perform the required practical tasks of the time, but the survival of the species has depended upon efficient performance of many tasks. Industrial arts, as a school subject, rests upon this long tradition of practical education. It has evolved, sometimes slowly, sometimes quite rapidly, to the present stage where it is a part of the education of a majority of America's young people. Detailed treatment of the historical development of industrial arts is outside the scope of this review. The discussion here is centered upon the major themes fundamental to the contemporary curriculum developments in industrial arts. For more detailed treatments, the reader should consult the comprehensive histories of the field by Barlow (1967) and Bennett (1926; 1937).

Industrial arts content and methodology are related historically and philosophically to a diverse array of educators: Pestalozzi, Fellenberg, Wehrli, Rousseau, Comenius, Moxon, Locke, Mulcaster, Petty, Luther, and others (Bennett, 1926). For the purpose of this brief review, the Russian system, the Sloyd system, and manual training are taken as starting points. These three educational approaches assimilated much of the earlier theory to provide the philosophical and operational bases for the development of industrial arts education in the United States. They were the most influential examples of the practicability of instruction in the use of tools and materials conducted within the school setting.

The Russian system of tool work instruction developed by Della Vos at the Moscow Imperial Technical School in 1868 emphasized the primacy of an analysis of the manipulative processes to be taught. An instructional sequence was then designed to foster the acquisition of the requisite manipulative skills. An ordered sequence of exercises was prepared for each area of work, with criterion-referenced requirements for progression through the graded steps in the series. The instructional system permitted a craftsman-teacher to provide efficient instruction to a class of young men working at their individual work stations (Bennett, 1937).

In contrast, the Sloyd system of educational handwork emphasized individual instruction by a professionally prepared teacher and the production of useful articles without the use of preparatory exercises (Salomon, 1896). Like the Russian approach, instruction in Sloyd was graded from easy to difficult, from the simple to the complex. The emphasis upon well prepared teachers in the Sloyd system led to the establishment of a teacher education program which received students from throughout the world (Feirer and Lindbeck, 1964).

Manual training, as it appeared in the United States, is most closely associated with the work of C.M. Woodward in the Manual Training School of Washington University. While manual training was closely patterned after the Russian system and related to the Sloyd system, Woodward rather quickly claimed some uniquely American values for it. He claimed, for instance, that manual training improved interest in other school subjects, reduced the drop-out rate, stimulated moral virtues, aided in occu-

pational choice, stimulated invention, increased the dignity of labor, and improved citizenship (Woodward, 1890). Manual training was, then, both general education in tool-material activities and vocational education in the industrial occupations of the time.

Manual arts instruction modified manual training by emphasizing creative design and the crafting of individual projects, with a reduction in the emphasis upon industrial occupations as the source of instructional content (Feirer and Lindbeck, 1964). Both the term, manual arts, and its methodology endured throughout most of the first half of the century, overlapping both manual training and industrial arts as accepted terms.

The classic definition of industrial arts as the "study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes" (Bonser and Mossman, 1923, p. 5) has guided most of the curriculum development in the field. From its earlier heritage, industrial arts adopted the analytical processes and group instructional methods of the Russian system; the general education aims and useful projects of the Sloyd system; the patterns of organization, emphasis upon guidance, and the vocational implications of manual training; and the planning and design emphases of manual arts (Feirer and Lindbeck, 1964).

Pressures shaping vocational education tended to differentiate between industrial arts and vocational industrial education. This approach seemed to define industrial arts by delineating those aspects of industrial education that were not industrial arts. This distinction became especially important to some vocational leaders following passage of the Smith-Hughes Act in 1917 (Drost, 1967).

Considerable curriculum innovation was stimulated by the State Committee on Coordination and Development (1934) in their "Ohio Prospectus," which became the prototype for much of the expansion of industrial arts programs throughout the country. The "Prospectus" recommended units in planning, communication, metals, textiles, transportation, woods, graphic arts, ceramics, personnel, foods, leathercraft, and jewelry for industrial arts courses. This group represented substantial broadening of industrial arts coverage from the earlier woodworking, drafting, and metalworking.

The professional associations have been quite active and influential in the evolution of industrial arts curriculum guides. Their publication programs give an indication of the extent of their involvement. The American Vocational Association published *Standards of Attainment in Industrial Arts* (1934), *Improving Instruction in Industrial Arts* (1946), and two editions of *A Guide to Improving Instruction in Industrial Arts* (1955; 1968). The American Industrial Arts Association published *The New Industrial Arts Curriculum* (1947), the U.S. Office of Education sponsored a conference report, *Improving Industrial Arts Teaching* (Schmitt, 1962), and the American Council of Industrial Arts Supervisors published *Industrial Arts Education* (1963; 1969), in addition to its continuing series of yearbooks. These sample publications indicate important trends in industrial arts, such as the tendency to attempt to meet fewer but broader

goals in the instructional program. Similarly, there are indications that industrial arts courses are themselves broader in their scope.

The number of instructional areas in industrial arts has decreased as such areas as art metal, pattern making, and forging have either disappeared or have been absorbed under broader subject area designations. The most recent publications give clear indications of the possibility of major structural change, despite the fact that there is still a tendency to allocate content within the framework of the traditional industrial arts subject areas.

The scope of the problem was indicated by Schmitt and Pelley (1966), who reported that industrial arts instruction was concentrated in three areas: woodworking, drafting, and metalworking. They expressed concern that instruction was not more evenly distributed, at least within the restricted range of industrial arts courses available in typical schools in their nationwide sample. Thus, while much has been written and recommended to relate industrial arts more closely to contemporary industry, the course content has tended to resemble subject matter which was popular in manual training days.

As industrial arts moved into the sixties, there were few indications of a sweeping reexamination of goals, purposes, or course content. The recommendations of such men as Olson (1963) were yet to receive the national distribution and discussion necessary to focus attention of the profession on the need for major curriculum change. There was a tendency to devote professional efforts to the gradual improvement, updating, and expansion of existing industrial arts courses, and the application of new instructional methodologies. The literature gave few clues that a new era of curriculum development was at hand.

However, social, economic and educational events were clearly creating a dissonance between existing industrial arts courses and the demands of the sixties. The time was right for the most widespread efforts ever devoted to the reorganization of the content and activities in the industrial arts curriculum.

EFFORTS OF THE SIXTIES

During the past decade, industrial arts education has been the scene of concerted efforts to improve its instructional program. Industrial arts educators of all persuasions have participated in a panorama of innovative projects. In addition to two major projects recently completed in industrial arts, several efforts are continuing as this review is prepared. Some involve relatively small scale attempts to upgrade or improve courses in a local or state area, while others are involved in efforts to integrate instruction in industrial arts with occupational programs of various types.

Comparative Studies

The bewildering proliferation of curriculum efforts in industrial arts has led to several comparative studies. Some have simply contrasted two or more approaches. In other instances, an attempt has been made to synthesize proposals and formulate new recommendations. In most cases, they provide more detail than it has been possible to include in the present review; the serious student should examine the works listed in this section.

Streichler included curriculum development efforts in his review of industrial arts research (1966) and considered the combined influences of the institute programs and selected curriculum projects (1970). He characterized the major trend in industrial arts curriculum development as a broad field of knowledge approach which attempted to identify concepts of industry and technology. He expressed concern that the newer approaches might be absorbed within the traditional structure of industrial arts without materially changing its form (1970).

In an unusual approach, at least for industrial arts, *Industrial Arts and Vocational Education Magazine* (1970) invited the proponents of seven outstanding positions to submit their views on the central purposes of their programs, to explain the differences between their programs and traditional programs, and to contrast their programs with other innovative efforts. In addition, each spokesman provided evidence on the degree of implementation of his program and its effectiveness and outlined plans for further development. This technique provided an effective means for direct comparisons among the selected curriculum approaches.

Cochran (1968) provided a comprehensive study of innovative industrial education programs, including a detailed analysis of seven projects from among the 35 programs he identified. He used a Q-sort technique to obtain data on 50 statements dealing with objectives, content, and teaching methods characteristic of the projects. He found that a majority agreed upon the importance of over half of the items in his survey, despite the fact that his sample included industrial arts and occupationally-oriented projects. Cochran reported general agreement to reduce emphasis on manipulative activities, while increasing the emphasis on research, development, and scientific activities. A multi-activity organization was common, but the content categories used in traditional programs were in disrepute among the respondents. A "middle-of-the-road" position was exhibited on such

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traditional industrial arts objectives as skill, craftsmanship, and consumer knowledge.

The results of this monumental study have been made readily available (Cochran, 1969a; 1969b; 1969c; 1970a; 1970b) and have been widely discussed. The findings are especially valuable since they were obtained from the direct responses of individuals in positions of responsibility for the curriculum projects studied as they reacted to a structured, standardized set of questions. Cochran's classification of innovative programs into four categories (integrative, interpretation of industry, occupational-family, and technology-oriented) is also helpful in obtaining a perspective to guide more detailed study.

Brown (1969) reported on eight innovative high school industrial arts programs identified in his survey for the American Vocational Association. While the study emphasized local innovations, Brown pointed out program features which could be of value in program development in similar situations. Householder and Suess (1969) reported briefly on a number of curriculum research efforts under way in the late sixties.

The interest in industrial arts curriculum development and the diversity of approaches advocated and practiced is especially evident in the presentations at the national conventions during the sixties. The convention proceedings of the American Industrial Arts Association (1964; 1967; 1968; 1970; Taxis, 1969) are particularly useful in providing a perspective on the progress of the respective projects. Since the convention presentations of curriculum innovators are presented with relatively little editorial condensation, it is possible to obtain a good orientation by examining the speeches carefully.

Funding Strategies

Curriculum researchers interested in curriculum reform of one sort or another typically begin their work by developing their ideas on a relatively small scale. If their initial efforts yield promising results, there is a tendency to seek some sort of institutional support. The second stage, for an educator, usually is in the form of released time to develop materials, the provision of equipment, facilities, or instructional materials, or the opportunity to explore the innovation with groups of students. Further funding, beyond the capability of the individual and his institution, is typically necessary to attain a higher level of development. For these purposes, funding has typically been sought from foundations and state and federal funding sources. It is difficult for a project to attain any sort of national visibility without major funding over a rather extended period of time. Such support has not been consistently available to industrial arts curriculum projects.

The Ford Foundation moved into the realm of vocational education and began funding projects in 1963. Among the first grants were nine for curriculum development efforts (Ford Foundation, 1967). While the projects were nominally "vocational" in intent, several of them included basic material and approaches of interest to industrial arts educators. Among them were several of the projects included in this review. For instance,

Cogswell Polytechnical College received funds to expand the "Richmond Plan," and New York City received a related grant. Stout State University received a grant which helped start the American Industry Project; Western Washington State College received funds for the VICOED Project; and Central Michigan University received funds for the Partnership Project. While the Ford Foundation has not continued its support of such programs at the level at which it was involved in the mid-sixties, the early support was most important in encouraging curriculum research and developing projects to a level necessary to obtain federal funding. The lack of similar contemporary support makes continuing curriculum development impossible or difficult of attainment at best.

Classification Schemes

Before turning to a detailed analysis of specific proposals and projects, it may be helpful to explore ways in which curriculum research in industrial arts can be categorized. Swanson (1965) categorized curriculum efforts according to four fields of study: common life needs related to industry or technology; crafts, trades, processes, tools, machines, and products; applications of mathematics and science; and industry. Cochran (1970) also used four categories: technology-oriented; interpretation of industry; integrative; and occupational family programs. Neither system seems fully satisfactory for the present purposes.

Some industrial arts curriculum research is primarily analytical, some is speculative or philosophical, while some is primarily action-oriented. Proposals run the gamut from evolutionary to revolutionary, from local to universal. Some are discipline-oriented, some content-centered, some are integrative. There is a strong occupational or career emphasis in some projects, other approaches maintain almost total commitment to general education purposes. Among the current programs are some proposed for one grade, some serving several grades, and some which are totally comprehensive in grade level coverage. Most of the projects do include work which is considered appropriate for some junior high school students, but the range upward and downward through the grades is anything but consistent across the projects.

A completely pragmatic approach has been used to group the curriculum development endeavors reviewed in this paper. Those which seem to be based most closely upon either industry or technology are grouped together and discussed first. Programs centered around the development of the individual and projects with a career development or occupational emphasis are discussed as alternative strategies. Finally, the review considers projects which are characterized by an evolutionary approach to the improvement of industrial arts.

It is recognized that this classification scheme is somewhat arbitrary and artificial, if not capricious. It has seemed to be useful in demonstrating similarities as perceived by the reviewer; however, other schemes could well have worked more efficiently. It is hoped that the reader will find the system usable and that the curriculum researchers will not be offended

by the placement of their endeavors in categories which may at times seem a bit foreign.

An additional comment before turning to the review: since this paper is prepared primarily for knowledgeable readers, it has not been thought necessary to include extensive information about institutional affiliation, project personnel, or historical evolution for each of the projects. For this information, as well as additional detail, the reader should consult the resources cited in the bibliography.

INDUSTRY AND TECHNOLOGY AS BASES FOR INDUSTRIAL ARTS

The largest number of curriculum efforts in industrial arts education during the past decade have drawn their content from industry and/or technology. Because the various curriculum specialists do not agree upon definitions, this review will not posit a precise definition of either "industry" or "technology." Rather, the terminology of the curriculum investigators will be used in describing their projects.

Industry has been implicitly accepted as the source of industrial arts content by many industrial arts educators. In a general way, it usually includes the activities involved in producing consumer goods, and sometimes the activities involved in their distribution and servicing as well. Large, extensively funded projects are not necessarily required to conduct an effective curriculum investigation in this area. For instance, two excellent individual efforts may be cited as examples of research to identify industrially oriented content.

Berry (1967) studied industries in a six-state area and formulated recommendations for industrial arts content and organization. Sample instructional materials were developed and specific suggestions were offered for achieving industrial arts objectives within the framework of the identified content. Kicklighter (1966) developed an elaborate, detailed taxonomy of industrial enterprises. His comprehensive scheme provides a means of developing, classifying, communicating, and revising the breadth of content suitable for industrial arts courses.

However, most projects to be reviewed are of a more extensive nature. Those which are considered to draw their content primarily from the industrial area are reviewed in the section immediately below; technology-based approaches are grouped in the next section.

Industry-Centered Approaches

Alberta Plan

A unique, four-phase industrial arts curriculum has been developed at the University of Alberta (Ziel, LeBlanc and Manuel, 1966). The first phase, for seventh grade, involves tools, machines, materials, and processes in the areas of electricity, graphic arts, ceramics, plastics, woods, and metals (Gallagher, 1964). At the eighth and ninth grade levels, students enter the second phase, a study of seven areas of technology: power transmission, electronic technology, mechanical technology, testing technology, graphic communications, power technology, and computer technology. The experiences in this phase are intended to provide synthesizing experiences and to reinforce instruction in the academic disciplines.

In the tenth grade, students experience simulated industrial situations in the third phase, which focuses upon the human roles in industrial organizations. Learning activities are based upon organizational structures, decision-making, communications, and authority configurations (Gallagher, *et al.*, 1968). The culminating level, phase four, provides eleventh and

twelfth grade students an opportunity to pursue research and development activities in one or more of the technologies studied in the second phase. Prototypes or experimental projects are typical outcomes of this advanced level of instruction.

Field study data which have been made available on the project (Gallagher, *et al.,* 1968) indicate that the junior high school students in the experimental treatment groups successfully increased their understanding of Alberta industry and improved achievement in the academic disciplines when their work was contrasted with that of students in the control groups. It is unfortunate that information about this sophisticated approach has not been more widely disseminated and that it has not produced instructional materials available in the United States. However, it has been widely used in Alberta.

American Industry Project

The American Industry Project has recently completed a long-term effort to organize an instructional program intended to help students develop an understanding of concepts which apply directly to industry and to develop the ability to solve problems related to industry. Three levels of course work were identified: Level I for a broad view of the concepts of industry; Level II for in-depth study of concepts and their interrelationships; and Level III for independent study in self-selected concept areas. An excellent report of the purposes, methodology, and outcomes of the American Industry Project has just been made widely available (Anderson and Olstad, 1971).

Much of the early analytical work of the American Industry Project was devoted to the development of a conceptual framework to encompass the spectrum of American industry (Face and Flug, 1965). A group of 14 basic concepts was identified and used as a guide for the initial development and field study of the instructional materials. The conceptual structure was subsequently revised to include 13 concepts: communication, energy, processes, materials, production, management, marketing, transportation, finance, property, research, procurement, and relationships. The sphere of "American Industry" is pictured as being surrounded by these 13 concepts, which are in turn surrounded by a ring representing the environment of American industry, including government, public interest, private property, competition, and resources (Gebhart, 1968).

A systematic developmental approach was created for the refinement of the conceptual structure, the concept models, and the definitions of concepts. The content of Level I (eighth grade) course material was organized in hierarchical order within the cognitive, psychomotor, and affective domains (Gebhart, 1968). Content for Level I was organized into a series of seven units: industry today, evolution of industry, organizing an enterprise, operating an enterprise, distributing products and services, future of industry, and the students' business venture. Instruction was designed to move from teacher-directed activity to student-directed activity as the class progresses through the course (Anderson and Olstad, 1971).

Throughout the period of the American Industry Project's work, the profession was kept well informed of its activities. Convention reports by Face and Flug (1965a) and Face (1967) served to outline rationale and procedures in open forum. Convention presentations were supplemented by a variety of project publications designed to provide information on the progress of the project as it evolved.

The teacher education program affiliated with the American Industry Project utilized a unique model of teacher characteristics to guide its curriculum development (Sedgwick, 1966). Research data and authoritative opinions were consulted to classify teacher characteristics as modifiable or not modifiable. Teacher education candidates could best be selected on the basis of the non-modifiable characteristics, and an instructional program could then devote its attention to the modifiable characteristics.

The teacher education curriculum in American Industry emphasizes a unified six-semester professional course involving seminar and teaching laboratory experiences. The teacher education effort has been developed as an undergraduate major in American Industry and a graduate concentration in American Industry as a part of the master's degree program. In addition, off-campus in-service programs and on-campus institutes have been conducted for industrial arts teachers and supervisors, and for teacher educators from nine universities, who then conducted institutes at their own institutions (Anderson and Olstad, 1971).

A complete group of instructional materials has been developed for Level I American Industry instruction. Included are an instructor's guide, overhead transparencies, 35mm slide series, a filmstrip, and a 16mm film, in addition to a set of seven student booklets, one for each unit. These materials have been subjected to extensive field testing, evaluation, and revision (Anderson and Olstad, 1971).

The evaluation procedures used by the American Industry Project were outlined by Nelson (1967; 1968). Three domains were included in the evaluation program; ingredients (learning materials, teachers, students, schools, community); processes (teaching acts, learning activities, school environments); and products (students, teachers, schools, parents). The evaluation model for the instructional environment involved a spiral which moved through succeeding stages of objectives, learning expedients, tests, evaluations, and decisions. Outlines were evaluated in terms of sequencing and difficulty levels, using accepted taxonomies as criteria. Readability of all instructional materials was also evaluated.

Egan (1966) studied the attitudes of students enrolled in American Industry courses and found that students liked American Industry better than their other courses. The usefulness or utility of the course was its major positive influence upon student attitudes. Students were interested in increased laboratory experiences as a part of their American Industry course; lack of activities and poor teacher organization tended to create negative student attitudes.

In a comparison of the results of American Industry instruction with conventional instruction, Nelson (1968) found that students who took

American Industry courses demonstrated a more positive shift in attitude toward industry, better knowledge of job opportunities, and greater interest in seeking industrial employment. A high degree of student acceptance of the instructional program was accompanied by satisfactory achievement. Anderson and Olstad (1971) reported that student performance on the achievement test indicated that one-year courses were superior to one-semester courses, that the more experienced American Industry teachers were more effective, and that close adherence to the American Industry outline and materials improved student performance.

All available evidence indicates that the American Industry Project has contributed substantially to industrial arts curriculum development. A useful conceptual model has been produced and a significant body of instructional materials has been prepared and field tested. Evidence has been provided on the successful implementation of the American Industry approach in many school settings. In addition, teacher education efforts have supplemented the curriculum development work in a meaningful way.

Enterprise: Man and Technology

Stadt, *et al.,* (1969a; 1969b) have proposed an alternative to industrial arts entitled "Enterprise." This approach reaches beyond the scope of most industrial arts curriculum development projects to provide broad, prespecialized occupational experiences. It involves laboratory experiences, homework, classroom activities, visitations, and cooperative work experiences in the wide variety of individual and group endeavors encompassed under the term. Following the initial experiences in the enterprise setting, the instruction moves into four technologies: electronics and instrumentation; visual communications; materials and processes; and energy conversion and power transmission. Following the introductory course, a second level of experiences is provided in the enterprise setting with the intent of assisting in occupational selection. Actual preentry occupational education is then provided in advanced courses in enterprise or in existing occupational programs.

Nystrom (1969) presented a pyramidal model of the American enterprise system, with upper management at the top and production at the base. Such areas as programming, automation, quality control, labor relations, economics, maintenance, scheduling, distribution, sales, and operations management comprise the sloping areas of the pyramid. Nystrom then demonstrated the relevance of the enterprise instruction to generally accepted goals of industrial arts as stated by the American Vocational Association (1968).

The interrelationships implied in the program title, "Enterprise: Man and Technology," were discussed by Sullivan (1971), who presented an outline for a first level unit in an enterprise program for the exploration of the cluster of industrial occupations. A gaming technique was proposed for the instruction in work roles, finance, manufacturing, and marketing; an approach somewhat analogous to Junior Achievement. Evaluational techniques included individual reports on occupational roles as well as group evaluations of the instructional enterprise.

The Enterprise approach is highly provocative. However, time for additional developmental efforts will be necessary before it can be evaluated in competition with other alternatives which have been in operation for some time.

Functions of Industry

Bateson and Stern (1962; 1963) proposed that industrial education should seek to concentrate on the more universal or generalizable characteristics of industry. They defined industry as the social institution which produces and services products to meet man's material needs. Their analysis indicated that the goods-producing activities involved four functions: research, product development, planning for production, and manufacturing (both unit and continuous). Goods-servicing activities involved three functions: diagnosis, correction (adjustment, replacement, and repair), and testing. The basic structure of the analysis for goods-producing industries was validated by Stern (1964) using these functions: fundamental and applied research, product development, planning for production, and manufacturing (custom and continuous).

The Functions of Industry approach has not developed a body of instructional materials or sample course outlines for distribution to the profession, nor have controlled demonstration projects been reported. However, the ideas embodied in the system have remained viable (*IAVE,* 1970) and appear to have stimulated the development of a number of noteworthy local curriculum experiments. For instance, in the "Parma Approach" (Barella and Stoper, 1969; Barella, Buchanan, and Stoper, 1968), a junior high school course was developed to provide experiences in the functions of industry. In-class corporations were formed, products were designed, produced, and sold, and profits were distributed. Outcomes included the development of a required seventh grade course, "A Study of Manufacturing," in-service workshops for other teachers, and plans to develop sequential experiences for the later junior high school courses.

The manufacturing process as a base for content organization has also received rather widespread attention in industrial arts education. Hacker (1969) reported upon the development of a seventh grade course in manufacturing which included experiences in limited craft production, materials testing, and a major mass production project. In this program, too, students designed, produced, and sold a product under the sponsorship of an in-class corporation. Hacker (1970) is one of the few local innovators to report the outcomes of curriculum change. When their achievement was compared to that of students enrolled in the conventional course, students in the experimental manufacturing course demonstrated more knowledge about the organization of industry, about tools, and about the organization of mechanical operations.

Duffy (1970) has developed what appears to be a later generation proposal in the Functions of Industry tradition. He proposed a junior high program emphasizing conceptual understandings in courses entitled: "Introduction to Materials Processing," "Production Processing," "Energy Processing," "Information Processing," and "Communication." More

specialized elective high school courses were suggested to provide in-depth experiences in these areas. This proposal, while apparently not yet in effect in demonstration centers, would seem to indicate a broader view of the functions of industry. It appears to expand the functional approach to a wider array of industrial enterprises than the goods-producing and goods-servicing industries included in Bateson and Stern's initial proposals.

Despite the fact that it has not been substantially funded at any time, despite the absence of concerted efforts to develop the rationale, guidelines, and instructional materials, and despite the lack of centrally-guided field studies and demonstration centers, the Functions of Industry approach has exerted considerable influence for curriculum change in industrial arts during the past decade. Individual teachers and small professional groups have been able to adapt the rationale to their situations and develop their own programs to meet their peculiar needs. While the outcomes are still indeterminate, the evidence available indicates substantial satisfaction with the results which may be attributed to the Functions of Industry approach to curriculum development.

The Industrial Arts Curriculum Project

The Industrial Arts Curriculum Project (IACP) is unique in several ways. It is the only major industrial arts curriculum effort which has been rooted in an analysis of the structure of knowledge. It is the first project to produce instructional materials and a sequence of courses correlated with a taxonometric classification of a body of knowledge. The intensive field testing and in-service teacher education which accompanied the development have been unequalled. Finally, IACP is the only program which has produced a substantial group of integrated instructional materials and made them available through a commercial publisher. In view of these attributes, IACP is considered by many to be the outstanding accomplishment of the past decade in industrial arts curriculum development.

Four domains of knowledge were identified by the IACP analysis: descriptive, formal, proscriptive, and praxiological (Towers, Lux, and Ray, 1966). Praxiological knowledge, or the knowledge of efficient action, was taken as the area for further study. Industrial arts content was identified from the realm of industrial praxiology, the study of the principles of industrial practices. Other practical arts subjects and vocational areas should also be based upon portions of the body of praxiological knowledge, according to Lux and Ray (1970). For the purposes of the Industrial Arts Curriculum Project, industrial arts was redefined to mean an "organized study of the knowledge of practice within that subcategory of the economic institution of society which is known as industry" (Towers, Lux, and Ray, 1966, p. 43).

The next area of analysis involved the establishment of a working definition of industry for the purposes of the project. Five basic social institutions were identified: familial, political, religious, educational, and economic. The economic institution was defined as the institution de-

signed to provide economic goods through material production and other economic activity. The material production phase of the economic institution was defined as the output of the genetic, extractive, manufacturing, and construction processes. Industry, as the appropriate domain for study in industrial arts, was defined as that portion of the economic institution (manufacturing and construction) responsible for substantially changing the form of materials to satisfy man's wants (Towers, Lux, and Ray, 1966).

A three-dimensional paradigm was used in subsequent stages of the analysis of the body of knowledge. The controlling dimension is industrial management technology (planning, organizing, and controlling); the second dimension is industrial production technology (pre-processing, processing, and post-processing); the output or third dimension is stated in terms of industrial material goods, either manufactured (in-plant) or constructed (on-site). Within the frame of reference implied by the three-dimensional analysis, detailed subject matter identification was conducted in six specific areas: industrial management technology; industrial production technology; industrial material goods; construction technology; manufacturing technology; and industrial personnel technology.

Two courses were developed from the identified subject matter in the body of knowledge in industrial praxiology. The first year's course covers "The World of Construction"; the second one-year course covers "The World of Manufacturing." Developmental materials for these courses were tested in field evaluation centers throughout the country over a four-year period, evaluated, and revised before they were made available commercially (Peter, *et al.*, 1969).

The instructional system used by the Industrial Arts Curriculum Project was designed to provide appropriate experiences for each day of the course. Hauenstein (1968) outlined the processes for providing both software and hardware from the first outline of the written material to production and distribution of the final materials. Selected portions of the content taxonomy used by IACP were also subjected to validation studies (Mason, 1969) and revised where necessary.

Throughout the development of IACP materials, the profession was kept well-informed of its progress and activities by means of journal articles (Lux and Ray, 1969; 1970; Peter, *et al.*, 1969) and presentations at conventions (Lux, 1967; Blum, 1968; Buffer, 1968; Hauenstein, 1968). Such communications served the vital function of keeping professionals informed and interested in the project activities; it also stimulated the awareness of the need for change and built a degree of "readiness" for the use of IACP materials as they became available.

Teachers who served in the field evaluation program were provided with an in-service orientation program conducted by a local leader who had received an eight-week orientation program at IACP headquarters (Blum, 1968). Feedback from teachers in the field evaluation centers involved individual teacher daily evaluations and weekly seminar reports. Data obtained from students included achievement test performance and opinion statements relevant to the interest levels and suitability of the materials and activities (Buffer, 1968). An extensive program of in-service

teacher education was conducted on 16 campuses during the Summer of 1970 and 45 campuses during the Summer of 1971.

Following development, field testing, and revisions, the first set of Industrial Arts Curriculum Project materials became available in time for the opening of school in the Fall of 1970. The materials for the one-year course in "The World of Construction" included a textbook, laboratory manuals, and a teacher's guide (Lux, Ray, and Hauenstein, 1970a; 1970b; 1970c; 1970d). Similar materials became available for "The World of Manufacturing" during the Summer of 1971 (Lux, Ray, and Hauenstein, 1971a; 1971b; 1971c). In addition to the "software" for teaching the IACP program, hardware was also made available where items are not typically obtainable from local sources.

The Industrial Arts Curriculum Project has attained a new milestone among industrial arts curriculum development efforts—commercial availability of a complete instructional system for an innovative industrial arts program. Professional acceptance as of the date of this writing has been quite promising. Sales of the publications have been good, and enrollments in the in-service teacher education programs have been high.

Orchestrated Systems Approach

Yoho advocates a global approach to the development of an industrial arts curriculum (1967). He adapted systems analysis procedures and developed a series of models called SNAP (Systems Network Analysis Process) MAPS to depict the roles of the various subsystems in the total society (1969a). He first places education in context within society, then moves to analyze the interrelationships in the production and consumption of goods and services. Consumer products manufacture is analyzed to illustrate the third stage in the analysis, and parts forming and processing systems are examined as a sample of the fourth level of analysis. Yoho contrasts his system for the identification of the "orchestrated" or systematized elements in the system with the usual method of identifying content for industrial arts by factoring out blocks of content, problems, sample experiences, or concepts to organize into an industrial arts program (1969b).

The "Orchestrated System" organizational pattern for industrial arts relies upon an orchestrated manufacturing enterprise to provide direct experiences in the "game-in-play." Beginning students are introduced directly into the production system in an industrial enterprise laboratory where a product is planned, parts are manufactured, and the product assembled, packaged, and shipped or stored. Surrounding the "game-in-play" area in the paradigm are "bull pens" for learning and practice in many areas: work measurement; methods improvement; methods study; packaging and shipping; maintenance; communication, drafting, schedules, and work specifications; jig and fixture design and production; manufacturing processes and training; product design, research and development; plant layout and materials handling; gage and tool making, tool-up and training; hydraulics-pneumatics and automation systems design; instrumentation and electronic control; and quality control. This model (1969b) is one of the

most comprehensive presentations of an idealized industrial arts program available in the literature.

While the Orchestrated Systems Approach has not yet demonstrated a complete pattern for implementation, it is an unusually promising approach. Because it uses a unique system of analysis to identify its content and activities, and because much of its terminology is foreign to industrial arts educators, it is not readily understood by the casual reader. As a pattern for curriculum development, though, it appears to be highly competitive with other, more conventional analytical methodologies.

Technology-Centered Approaches

Technology, as a total system and influence, is central to several proposals for industrial arts curriculum development. Lauda (1969) distinguished between industrial arts as an interpretation of industry and industrial arts which interprets society from a technological standpoint, with an emphasis on the effects of technology upon man. Lauda (1970) indicated that technology should become the core of the educational program and that the industrial arts program would need to be revised to assist in preparing individuals to make the decisions necessary to control technology and use it for society's purposes. DeVore (1970) suggested that the schools should concentrate upon instruction in technology, science, and the humanities, as well as the provision of a base of knowledge required for entrance into and adaptation to the world of work.

This section reviews two major proposals for the utilization of a technological base broader than the industrial system as a basis for industrial arts curriculum development efforts.

Industrial Arts as the Study of Technology

One of the early advocates of a broad technological base for industrial arts was Olson (1957), who has consistently expressed concern that industrial arts be redirected to reflect technology. Olson recommended six functions for industrial arts: technical competence, occupational orientation, consumer competence, recreational liberation, cultural appreciations, and social competence (1963). After defining technology as the material culture, Olson defined industrial arts as the study of technology in its broadest sense (1968).

Olson's comprehensive outline of subject matter for industrial arts (1963) is based upon the functions he posited for industrial arts, and details content for industrial arts from a wide range of industries: manufacturing, construction, power, transportation, electronics, industrial research, the services, and industrial management. Olson also developed guidelines for the development of industrial arts programs at all educational levels from kindergarten through the doctorate.

While the literature does not indicate substantial field testing of Olson's proposals, their comprehensive nature gives them considerable appeal. The influential nature of the analysis is evident in a number of curriculum developments.

Technology as a Discipline

DeVore recommends the analysis of technology to obtain content for industrial arts (1967a). Four major steps in industrial arts curriculum development are involved: establishment of a taxonomy of technology, a content reservoir; identification of basic concepts and principles in the reservoir; preparation of units of instruction on concepts and principles; and establishment of courses of study by grouping the units. Three major areas in technology are identified: production, communication, and transportation (1967b).

DeVore (1970b) provided an illustration of his taxonometric analysis in the area of transportation technology. Starting with the discipline, technology, he moved to the technical element of the discipline and the transportation area within it. Four major divisions were identified for the area: terrestial, marine, atmospheric, and space. A more detailed analysis establishes the placement of transportation systems, propulsion, structures, guidance, control, suspension, and support within the framework of the structure of the discipline (technology): knowledge structure, concept taxonomy, principle taxonomy, process taxonomy, functional relations, and social-cultural elements (1970b). Alexander (1970) discussed the merits of the taxonometric approach to transportation technology and indicated ways power and technology could be included as a part of the transportation analysis. He emphasized the utilization of purposeful manipulative experiences as critical to the success of a technology-based industrial arts program.

DeVore emphasizes the value of his research process in the establishment of methodology for teaching industrial arts, with the inquiry moving through stages of what to teach and to whom; what to teach and when; and when to teach and how to teach it (1970a). In emphasizing the general education role of industrial arts, DeVore (1967a; 1969) has undertaken the difficult task of organizing and categorizing the array of content encompassed by technology. While this vital work has not yet been completed, it has already yielded useful analytical tools and preliminary taxonomies which have been effective guides in the organization of instruction. The acceptance of technology as a discipline and as a base for industrial arts instruction would mean a major shift toward breadth in content coverage—an exciting development to contemplate at the moment, but also a potentially viable alternative for the future.

ALTERNATIVE STRATEGIES

In addition to curriculum development efforts centered around industry and/or technology, a group of projects have been concerned primarily with career or occupational preparation of one sort or another. Another area of primary emphasis which can be identified is the development of the individual student, without specific regard to the subject matter or occupational values of the experience. The first part of this section reviews two individual-centered approaches to the industrial arts curriculum. In the second part, the arguments for and against career and occupational purposes as a part of the industrial arts program are discussed, and several representative projects are described.

Individual Development Emphasis

Maryland Plan

Donald Maley has been one of the field's most prolific writers and speakers on matters related to the industrial arts program. His recommendations have evolved over a period of time, but are perhaps best known as the "Maryland Plan," a series of proposals for the industrial arts curriculum at the junior high school level. In the Maryland Plan, the individual is considered to be primary; hence the purpose of industrial arts is the development of individuals, rather than the production of things (Maley, 1967a).

This unique emphasis upon human development precludes the extreme concern with content or subject matter which characterizes many curriculum efforts. The content of industrial arts in the Maryland Plan is related to the other subject areas in the school. Industrial arts, using a laboratory environment, is considered to be the means for providing firsthand experiences with the materialism and technology of mankind. The role of the teacher in the Maryland Plan is primarily in the design of learning experiences. The unit approach, research and experimentation, group project, and line production methodologies characterize instruction under the Maryland Plan.

The Maryland Plan provides for an anthropological approach to the study of tools and machines, power and energy, and communication in the seventh grade, utilizing the unit method as the primary instructional approach. Group projects and line production characterize instruction in the eighth grade course in the study of American industry. At the ninth grade, the Maryland Plan provides a number of alternative approaches: contemporary units, research and experimentation, group projects, line production, and individual or group technical development. The ninth grade emphasis is on developing the individual through increased depth of study of contemporary units (Maley, 1967b).

The active student involvement expected in the Maryland Plan is indicated by goal statements which require students to construct, compare, use, describe, apply, develop, carry out, solve, and interact as they complete the instructional activities (Maley, 1969). The approach depends upon

student involvement and the stimulation of the student to perform effectively in obtaining firsthand information, a concept of education as learning through living.

Maley has recently extended his approach to provide recommendations for industrial arts in the senior high school. He has proposed a program for these school years based upon the application of technology to the solution of mankind's social, environmental, and operational problems (1970a; 1970b). Once again, the methodological emphasis is strong, but the instructional areas investigate vital contemporary issues. Major problem areas include pollution, power, housing, water, communications, conservation, production, transportation, and resource utilization.

In the senior high school program, Maley emphasizes individual inquiry and involvement, increased utilization of library resources and instructional media, and the role of the teacher as an educational manager. Specific suggestions are provided for incorporating the unit approach (including problem-solving), the group project approach, and the research and experimentation method in organizing instruction across these problem areas.

The Maryland Plan has received an unusually high degree of acceptance in the public schools. Brown and Haney (1969) reported on the design of facilities to accommodate their junior high school program. In this setting, the seventh grade course involved an anthropological study of man's technological achievements, the eighth grade studied industrial organization and production methods, and the ninth grade program involved contemporary industry, technology, and research and experimentation. Brown and Haney presented a facilities design for implementing the Maryland Plan, with a seminar room, a research and testing center, and proximity to science laboratories and the library as major design features. Starkweather (1970) discussed the development of a senior high school program in transportation, communication, pollution control, conservation, housing, power generation, production processes, and natural resources. The courses in "Industrial Processes" provide hands-on experiences for students at all ability levels and create high levels of motivation and achievement.

Maley's recommendations for industrial arts curriculum development have maintained a heavy emphasis on methodological considerations, an approach which has assisted industrial arts teachers in adopting his ideas. The Maryland Plan has been highly successful in a variety of school settings, and should maintain its present high degree of acceptance if it continues to accommodate effectively to changing social, economic, and technological conditions.

Technology for Children Project

Hunt (1967) presented a psychologically-based rationale for the "Technology for Children Project." The theoretical base assumes that the elementary school child is motivated to respond to all kinds of stimuli; that this spontaneous interest in learning creates an impressive preschool body of competencies; and that environmental deprivation retards the develop-

ment of intelligence. The rationale emphasizes technology as the result of man's ability to think about and solve problems in the material world.

On these bases, the project emphasizes four themes: design, properties of materials, use of tools, and instrumentation. The intent was to create a rich classroom environment and to provide a degree of guidance in working with it. The emphasis is not upon the coverage of specific content; rather, the experiences of each child are considered to be unique and to provide a rich learning situation.

The enriched classroom environment created by the project includes tool panels, work benches, work surfaces, sawhorses, and a set of tools (Hunt, 1968). If possible, desks are removed to create a technologically-based environment designed to help students think about and deal with the social and physical environments.

Two phases are integrated in the project: Institute and Classroom. During the Institute phase, practicing elementary teachers are involved in a long-term, intimate observation of the summer program in operation (Stunard, 1968). During the Classroom phase, teachers are encouraged to implement the project in their own classrooms during the school year, with a consultant available to assist them in planning and conducting their classroom activities (Dispensa, 1968). Stunard (1968) estimated that approximately two complete cycles of institutes and classroom implementation are typically required to convince a teacher of the value of the approach and to develop competence in its effective conduct in their classrooms.

The unusually well integrated teacher education program used by the Technology for Children Project is a feature which should be helpful in other curriculum development efforts. The high degree of emphasis upon the individualization of experience in a rich technological environment also deserves wider application. There are relatively few formal efforts to improve the industrial arts experiences available in the elementary school; this one is quite outstanding.

Career-Occupation Emphasis

One of the major issues facing industrial arts education in recent years has been the appropriate degree of emphasis which should be placed on career development or on the preparation for occupational competence as a part of the instruction in industrial arts courses. While the argument is essentially philosophical, it has such significant implications for the industrial arts curriculum that it seems important to discuss it here.

Pratzner (1969) recommended the replacement of the typical industrial arts program with an "Occupational Development Curriculum" intended to provide exploratory experiences across the practical arts areas in the junior high school. He advocated discarding many of the traditional industrial arts objectives and emphasizing interest in occupations and the development of worthy leisure time interests. At the senior high school level, he advocated a required program of "Occupational Development," involving a work-study program, independent occupational studies, and small group

activities. Under this plan, specific vocational training would be conducted at the post-secondary level.

Nelson (1970) recommended modification of the existing senior high school program as necessary to include information about and preparation for post-secondary occupational programs. He suggested an emphasis upon the development of good habits of learning and working, the use of the community as a classroom, and such prevocational learnings as adjustment to job demands, honesty, dependability, loyalty, and flexibility. He argued that it was possible for industrial arts programs to meet such recommendations within the framework of existing objectives, courses, and facilities.

Lux (1971) took exception to Nelson's recommendations, and argued that the occupational use of the body of knowledge identified as industrial arts is only one of the many purposes to which the knowledge may be applied by the learner. He indicated that industrial arts should serve technical, recreational, consumer, cultural, and social purposes as well as occupational purposes in the educational enterprise. Lux emphasized his position that occupational or vocational education is a purpose, not a body of knowledge; while industrial arts is a body of knowledge which may be used for any of the six educational purposes he outlined.

In a third article in the series, Bradley (1971) argued that instruction in industrial arts courses could stimulate interest in future vocational pursuits. He went on to emphasize the need for practical instruction oriented to the value of work, dignity and pride of accomplishment, and individual development. While Bradley did not recommend that industrial arts should assume the total spectrum of occupational preparation, he did indicate that industrial arts should provide an effective foundation for later, more specific vocational courses.

Venn (1969) urged industrial arts educators to expand their programs to provide the exploratory experiences needed to make a wise career choice and the basic skills useful in many occupational endeavors. At the same time, he indicated that industrial arts should continue to attempt to fulfill its other objectives, especially the function of nurturing creativity. Carrel (1969), Olson (1969), and Woodward (1969) expressed reservations concerning Venn's proposal. Each indicated that a major emphasis upon an occupational orientation function for industrial arts would restrict the ability of industrial arts to meet its full array of educational purposes.

DeVore (1970c) recommended that the primary responsibility for specific occupational preparation should be placed upon the business and industrial employers, and cited instances of effective programs operated by corporations. Kabakjian (1970) recommended the expansion of industrial arts programs as a means of providing a broad range of experiences at all educational levels in order to reduce the dropout rate and improve the accuracy of career selection.

In one of the most powerful proposals to date, Marland (1971) suggested a comprehensive program of career education to encompass both general education and vocational education. He proposed that secondary education should prepare every high school graduate either to enter higher education or to begin employment. The major changes in emphases implied

by this position have begun in some educational settings as this review is being prepared. While there is no way to predict accurately what the impact of the career education proposal will be, there are substantial indications that it will be most influential in the immediate educational future. Industrial arts programs seem certain to be affected, directly or indirectly, as they exist in conjunction with, in competition with, or in cooperation with career education efforts.

If one leaves aside for the purposes of this review the philosophical question of whether or not programs which are primarily vocationally, occupationally, or career-oriented may be considered to be a part of, all of, or none of industrial arts, then it seems profitable to examine curriculum development efforts in these areas. Several programs have been developed and implemented. More are under way at the time this review is being prepared. In many ways, they seem destined for increasing acceptance.

Partnership Project

The "Partnership Project" (Minelli, 1965) is unique among the curriculum development efforts reviewed here in that it was organized to provide industrial education experiences at three levels: secondary schools, community college, and university. The first level of experiences in the project is most pertinent to this discussion—a one-year course for ninth or tenth grades entitled "The Study of American Industry." The course outline indicates units in industry and civilization; industry; organization; research, design, and development; planning for production and manufacturing operations; manufacturing; distribution; and service (Cochran, 1970b). Minelli reported that 12 secondary schools were serving as cooperating centers in the introduction and implementation of this level of the project (*IAVE,* 1970).

Succeeding levels within the Partnership Project include a two-year sequence for eleventh and twelfth grades in which industrial-technical content is correlated with courses in English, science, and mathematics. A three-level industrial-technical program is outlined for those grades in order to serve students of varying abilities: an advanced level for college-bound students; a level for those bound for the labor force or community colleges; and a level for those considered most likely to enter the labor force, perhaps before graduation. In addition to the secondary school program, the Partnership Project includes provisions for technical education at the community college level and industrial teacher education at the university.

Throughout the Partnership Project, emphasis is placed upon the study of industry in its entirety and upon the interrelationships between industry and other social institutions. Flexibility is retained in program planning and provision is made for relatively high degrees of student freedom in the selection of learning experiences.

In an interim evaluation of the results of the project, Minelli (1970) reported that students in the program showed improved attitudes toward school, better grades, and improved attendance, indicating that the project met the needs of individuals better than the conventional programs. Similar

educational growth rates were exhibited by students in the project program and students in conventional programs. However, the project program was considered to be more interesting, both by experimental and comparison group students.

The vertical integration of educational experiences provided in the Partnership Project is a major curriculum innovation. Other applications may be expected to appear on the educational scene. The institutional cooperation implied in the "Partnership" term is also an important innovation which shows promise for wide acceptance.

Galaxy Plan

One of the early programs designed to orient students to a variety of occupations, assist in career selection, and provide basic occupational preparation was developed in Detroit (Cochran, 1970b). The "Galaxy Plan" is similar to a cluster approach in that it provides experiences in four major clusters: materials and processes, visual communications, energy and propulsion, and personal services. Turnquist reported that business education and electronics clusters were added to the group (*IAVE,* 1970). At the junior high school level, the Galaxy Plan provides for exploratory experiences in all the occupational clusters; increasingly specialized preparation characterizes the high school program.

McLea (1969) reported on the successful adaptation of the Galaxy Plan in an inner-city high school with the usual complement of seven unit shops. Despite the handicaps imposed by the facilities, the faculty arranged for the necessary flexibility to provide both one-hour and two-hour industrial arts courses, occupational courses, and a "student-in-industry" program. McLea recommended that buildings planned to accommodate the Galaxy Plan should include these facilities: laboratories for materials and processes, energy and propulsion, visual communications, and personal services; an auditorium for large group instruction; centralized storage; and an industrial arts resource center.

In a direct contrast in settings, Davison (1969) explained the successful implementation of the Galaxy approach in a rural high school, where the individualization of programs could be a reality. Again, the program provided for general education, job preparation, and vocational-technical school preparation within the framework of the four major clusters in the Galaxy approach. Industrial arts, business education, home economics, and agricultural education were encompassed in the program.

As a means for providing occupational exploration and preliminary preparatory experiences, the Galaxy Plan is highly promising. It is closely related to the "cluster" approach to vocational education, a pattern of curriculum organization which is not reviewed separately in this paper. The basic organizational strategy of providing experiences in related groups of activities across a wide range of endeavors is, however, an approach which is receiving increasingly widespread acceptance.

Pre-Technical Programs

A major developmental effort has been exerted to provide appropriate high school experiences for capable average students who can succeed in community colleges but who may not be motivated to succeed in high school. The "Pre-Technology Program" (Smith, *et al.*, 1966), formerly known as the "Richmond Plan," has been highly successful in providing correlated courses in English, science, mathematics, and technical laboratory in the eleventh and twelfth grades. While the basic content for the courses was identified through an analysis of the requirements for engineering technology, the program is considered to be general education to the degree that it prepares the student to be flexible in meeting changing job opportunities and filling a variety of roles in society.

The teaching units in the Pre-Technology Program are related to college-level technology programs. Instruction in the four courses is integrated so they can be team-taught throughout the program. Behavioral changes are specifically identified and criteria for successful completion of the program are stated in behavioral terms. Despite its success, its proponents caution that the Pre-Technology Program is ideally suited only for the capable average, technologically-oriented student—probably no more than 30 juniors and 30 seniors in the typical comprehensive senior high school of 2,000 students.

An outwardly similar approach, involving interdisciplinary planning, team teaching, and a laboratory orientation, has been used in the development of programs in other areas. A series of pre-technical courses for prospective engineering technicians and a four-year program for general students has been developed in New York City (Correlated and Pre-Technical Programs, 1967; Board of Education of the City of New York, 1967). It seems unusual that more school systems, particularly the larger ones, have not elected to utilize this successful model for curriculum development.

Introduction to Vocations

The "Introduction to Vocations" course (Beam and Clary, 1968) is one of the projects which has operated long enough to obtain realistic data for program evaluation. This course was developed for ninth grade students, based upon theory and research (Super and Overstreet, 1960) which indicated the need for the development of "planfulness for an occupational choice."

The Introduction to Vocations program sought to help students understand economic processes, human relations, and employment opportunities in the state. In addition, the program was intended to increase student understanding of their own interests and aptitudes.

In the initial evaluation of the first year's effectiveness, Clary and Beam (1965) reported favorable attitudes toward the course by students, parents, and administrators, and evidence that the course was meeting its objectives. The program effectiveness did not depend upon a team-teaching approach, though teachers from other subjects who worked on teams with Introduction to Vocations teachers were enthusiastic about the project.

Cox, Clary, and Duncan (1967) reported that the program, which had started with 45 teachers in 45 schools in 1963-1964, had grown to 223 teachers in 228 schools, serving over 10,000 students in 1966-1967. Evidence of widespread acceptance was clear. Duncan (1966) reported on the status of the program and on in-service and preservice workshops for teachers of the program. By 1968-1969, the program served an estimated 18,000 students in 250 schools in North Carolina (Robinson, 1968).

The revised teacher's guide for Introduction to Vocations (Beam and Clary, 1968) emphasizes the importance of student planning and decision-making in meeting the course objectives: the development of a realistic self-concept, knowledge of employment patterns and opportunities, an understanding of the American work economy, an acquaintance with major occupational fields, and the development of desirable attitudes toward work. Six major units comprise the course: relating one's self to occupations; the economic system; manual and mechanical occupations; clerical, sales, and service occupations; professional, technical, and managerial occupations; and evaluating and planning ahead.

The Northern New England Vocational Education Project has developed a four-year program with similar objectives. Activities for grade seven are centered among occupations in the community and in the school. Eighth grade instruction considers the clusters of occupations common in New England. The ninth grade program involves self-appraisal in terms of the world of work, and tenth grade activities are intended to assist the individual in selecting occupational clusters for consideration in his future education. At the time this review is being prepared, only a few descriptive materials have become available on the project. However, it has undertaken to provide occupational information and involvement throughout grades seven to 10. This approach seems quite likely to become more prominent in the future.

Career Development for Children Project

The "Career Development for Children Project" has strong roots in the field of guidance. Guidance systems, models, techniques, and programs were reviewed by Bailey (1970) as a first phase in the development of the approach to be used in the project. A model of career development was evolved to guide subsequent curriculum development efforts. The model (Bailey, 1971b) defines two major developmental tasks which the individual must master to attain vocational maturity: understanding of the self and understanding of the world of work.

Four stages of development toward vocational maturity are depicted for the school years, grades one through 12. The Awareness Stage includes grades K through three; grades four through six involve the Accommodation Stage; grades seven through nine are considered to be the Exploration Stage; and grades 10 through 12 are designated the Preparation Stage. The Career Development for Children Project is involved in the preparation of materials for grades one through eight, with a goal of assisting the student to formulate a tentative educational-occupational choice by the completion of the eighth grade.

At the time this review is being prepared, the basic structure for the eight-grade program has been outlined (Bailey, 1971a) and developmental work has started. For the Awareness Stage, materials for grade one dealing with purposeful activities have been developed and field tested. Software has been completed for grades two and three, covering interests and occupational roles. For the Accommodation Stage, grade four instruction will deal with self-appraisal, grade five with occupational families, and grade six will be devoted to an understanding of career development. Materials for the Exploration Stage include a seventh grade program in economics and career planning, using a modification of the work of Darcy and Powell (1968a; 1968b). Exploration and decision-making content in grade eight is intended to assist in planning an appropriate high school program compatible with self characteristics and occupational goals.

The approaches and procedures used in the Career Development for Children Project seem to be highly promising. In many ways, this project appears to be as closely attuned to contemporary thought on the elementary school curriculum as any program examined by the reviewer. If there is an increasing emphasis upon career development, and this seems likely, the Career Development for Children Project could make substantial contributions with its long-range, integrated approach.

EVOLUTIONARY APPROACHES

This section is devoted to a review of a group of curriculum development efforts which seem, at least to the reviewer, to be amenable to applications where the emphasis is upon the improvement of the existing industrial arts curriculum. The recommendations included here range from proposals for course revisions to full-fledged curriculum development projects. All seem to represent the search for a better way without necessarily advocating a major structural change in the industrial arts curriculum as it is generally found in the secondary schools.

Industriology Project

The Industriology Project is an attempt to improve and update industrial arts by increasing the breadth of its instructional program. A basic point of view statement defines "Industriology" as the science of industry (Brown, 1968). As a broadly based subject for study in the schools, industriology instruction considers industry in terms of two structural divisions: types of industries and activities of industries (Jackman, 1968). Four types of industries are studied: raw materials or extractive, manufacturing, distribution, and service. Six basic industrial activities used in the project are: development and design, finance and office services, manufacturing or processing, marketing, industrial relations, and purchasing.

Fellowship programs in conjunction with the Industriology Project permitted rather early tryout and pilot studies of the approach in secondary schools. Kirby (1968) reported that the approach was concentrating upon laboratory activities, especially mass production. Such activities as paper making, casting, research and development, the preparation of organization charts, and work with concrete were popular in the early pilot studies. Even in the early stages, the project was supported by an instructional media effort (O'Neill, 1968), which has developed four scripted slide series as part of the instructional package.

The Industriology Project has structured a sequence of four phases in its program. Phase I, Development and Structure of Industry, provides an overview of industry for grades seven, eight, and nine. Phase II, Basic Elements and Processes of Industry, provides the content implied in its title for students in grades nine, 10, or 11. The third stage, Phase III, is entitled Modern Industries, a program for students in grades 10, 11, or 12. Phase IV, Vocational and Occupational Guidance, is intended to assist students in grades 11 and 12 in occupational selection and preparation (Wisconsin State University, a).

A series of instructional materials has been prepared for the first level of the industriology program, entitled Development and Structure of Industry. The series includes a teaching plan, a study guide, information and job sheets, and a list of instructional aids (Wisconsin State University, b; c; d; e). Four slide series have also been made available, covering the economic cycle, industrial activities, metal extraction, and

tire manufacturing. These materials can be utilized readily by the industrial arts teacher and have been an important factor in the dissemination of the industriology approach.

Implementation has spread to include a large number of schools across several states (*Pragmateian,* 1971). In addition, the approach has been shown to be useful in the elementary school. Jackman (1970) reported on a six-week pilot project using individual projects, mass production projects, and field trips with fourth and fifth grade children. He also indicated that the industriology approach adapts well to integration with other elementary school subjects.

The Industriology Project appears to have substantial appeal to practicing industrial arts teachers, who can work with and understand the materials and approach quite readily. It seems to adapt well to situations in which teachers are trying to modernize and strengthen their course offerings. As a consequence, it should be especially helpful in in-service programs and in situations where local groups are working on their own in curriculum improvement efforts.

Georgia Plan

An approach to industrial arts curriculum development advocated by Hackett (1964) has come to be widely known as the "Georgia Plan." Hackett provided a model for an industrial arts program as part of the overall educational system. Emphasis was placed upon a general industrial arts course for grades seven, eight, and nine, with instructional time approximately equally distributed between laboratory and classroom activities. The model then provides for two tracks in the industrial arts program in grades 10, 11, and 12: a pre-vocational track with general area and unit industrial arts courses; and a college preparatory track with courses in American industries, drafting and descriptive geometry, and research and development.

Surrounding the secondary model is an elementary education segment involving construction activities and the study of the world of work, and a special education segment across all grade levels to provide appropriate industrial arts experiences for students with unusual needs. The multitrack program is outstanding for its comprehensiveness and for the nonlaboratory course in American industries (Cochran, 1970b).

Hackett (1970) has also presented a model for a course in "Man and Manufacturing" and another for "Man and Transportation" (Cochran, 1970b). In each instance, the major technological area is studied in terms of its systems and the applications of the special features of the area. For instance, the manufacturing systems identified are: product development, production planning, tooling, producing, evaluating, packaging, financing, and marketing. The manufacturing systems are seen as involving applications of personnel, ideas, materials, processes, and products.

The Georgia Plan is closely related to other technologically-based curriculum approaches. However, it is structured so it can adapt to the organization of most school systems, permitting the development of a

comprehensive industrial arts program without creating serious operational difficulty. It has been successfully implemented in a variety of settings and can provide an example for subsequent curriculum innovations.

Materials Prepared under State Auspices

Until quite recently, the major responsibility for curriculum development and improvement in industrial arts education rested squarely upon the departments of education in the respective states. State supervisors tended to become involved in the preparation and dissemination of various kinds of curricular materials. Mahoney (1956) found much uniformity among the existing publications, but discovered that a majority of the states had not yet produced materials for their industrial arts teachers. Teachers, however, were interested in obtaining both course outlines and handbooks. Teachers were most likely to utilize those aspects of state materials which related directly to their classroom instructional problems.

In preparing the present review, the author elected not to attempt to review the large number of publications available from state departments of education. Space would not permit detailed reports and there would be a great temptation to become unduly repetitive. As a compromise, the reader is referred to two recent studies of state materials for bibliographical listings, for evaluative comments, and for more detailed information about the state-prepared publications. The present review will therefore be limited to the citation of highlights from studies by Koonce (1968) and Johnson (1969).

Koonce (1968) found 106 available resource publications on industrial arts available from 32 states. In addition, the majority of the states indicated an intention to add to or to revise their materials. The heavy emphasis on in-state utilization of these materials is typically fostered by free distribution of new or newly revised materials to practicing teachers, who are encouraged to modify the materials to meet the needs of their situations. Very few teachers utilized publications from other states, despite the fact that many found their own state's materials unsatisfactory for their classroom use. The more experienced and better educated teachers were more favorably impressed by the materials available within their state than were the beginning teachers with the bachelor's degree.

In another recent study, Johnson (1969) evaluated the content of 78 state handbooks for industrial arts. In comparing the emphasis on various topics in the handbooks with the recommendations of a panel of supervisors and teacher educators, Johnson noted that the jurors emphasized most topics more than did the guidebooks. This finding might be anticipated when one considers the space limitations imposed upon the typical handbook.

On the other hand, handbooks had a higher than recommended emphasis on several topics: safety, shop planning, and material on the teaching of specific industrial arts courses, such as drawing, electricity/electronics, metalworking, woodworking, and so on through the traditional subject matter designations used by the schools. One might infer from

this finding that practice, to the degree that it is accurately represented by the handbooks, tends to emphasize traditional subjects, while "leaders" tend toward less emphasis of specific courses.

The jury in Johnson's study was strongly in favor of more broadly-based curriculum materials organized around such areas as manufacturing, communications, and power and transportation. Despite this recommendation, the handbooks published in 1962 and later did not demonstrate an increased tendency toward newer patterns of organization when they were compared to earlier handbooks. The extremely stable nature of the handbooks was noted; few major changes were apparent in the 20-year period covered by the study. The most recent guidebooks tended to move toward an emphasis on specific industrial arts courses, a direction diametrically opposed to the recommendation of the panel of jurors.

Subject Matter Areas

The specific subject matter areas within the industrial arts setting have frequently received attention from curriculum workers. Only a few examples can be cited here, since reorganization efforts result in a range of outcomes from a revised teacher's outline to a new series of textbooks.

Schwalm (1967) reported on the initial phases of an interdisciplinary approach to the development of a comprehensive curriculum in graphic arts for the secondary schools and community colleges. Industrial arts educators worked with professors of art, chemistry, economics, English, journalism, mathematics, psychology, sociology, anthropology, and physics in the development of the material. The analysis of methods of originating, reproducing, and handling visual information was conducted using a systems approach. The articulated curriculum which resulted was intended to provide prevocational orientation for students who planned to work following high school and pre-occupational/professional orientation for students attending a college.

Risher (1969) proposed a course in applied technical power as a replacement for power mechanics with its emphasis on manipulative activities. He recommended content covering the role of power in industrial functions, power producers, energy forms, energy sources, energy and power transmission, and experimental and research applications. The primary objective proposed for the course was to increase understanding of the influence applied power has upon the development of industry and technology.

In a similar vein, Duvall, Ellison, and Slobodian (1969) provided a weekly teaching outline for a six-week unit on diesel engines and suggested ways the coverage could be expanded to provide a one-semester course. Diehl and Kreuger (1970) reported on the effectiveness of units in rocketry, electric motors, and future power sources as part of a course in power technology.

While many more examples could be cited, these few serve to illustrate the types of professional involvement which have been devoted to the improvement of specific industrial arts courses. All of the usual industrial arts

courses, and many areas not found in most schools, such as plastics and ceramics, have received considerable competent attention during the past decade. These efforts have resulted in duplication, of course, since they tend to be relatively localized. They may also contribute at times to a tendency toward fragmentation and specialization within industrial arts. Nevertheless, the improvement of subject matter area courses represents one of the highly promising approaches to the problem of industrial arts curriculum development.

Though the research literature has not dealt specifically with two crucial influences on the industrial arts curriculum, it seems appropriate to consider them in this discussion. The selection of a textbook by a teacher, supervisor, or committee tends to predetermine the outer limits of the variety of experiences included in a course. By virtue of the use of their product, textbook authors assume the primary responsibility for the identification and presentation of instructional content, even though they cannot control the utilization of their texts. Similarly, equipment manufacturers and suppliers have been influential both in effecting curriculum innovation and in maintaining instructional stability. Teaching systems and kits have permitted the implementation of electronics courses, for instance, while other areas have retained their traditional posture, secure in the situation where nothing new is available to encourage innovation (Suess, 1967).

IN RETROSPECT

When one reviews the progress in industrial arts curriculum development which is apparent from an examination of the literature, he receives an impression of widespread concern and professional involvement in an urgent, pervasive effort to improve the industrial arts program. The extensive participation by individuals at every level of the profession is evidence that many have recognized the need to upgrade and update their curricular offerings and have committed themselves to the task.

Instructional Systems

Despite the long-term activities of many people, there is still no instance where an innovative industrial arts program has been implemented across all grade levels. There is a tendency to focus projects upon one or two grades or a restricted range of grade levels. In some instances, there are logical, theoretical, or philosophical bases for such restrictions, but many of them appear to have been made for convenience or to obtain a demonstration population. There are sporadic attempts to involve industrial arts teacher education in curriculum development endeavors; these results have not yet been fully satisfactory.

The magnitude of the task of attaining a modicum of unanimity among industrial arts curriculum specialists is indicated by Anderson (1970). He proposed a major national consortium to undertake the synthesis of a set of national guidelines for program development and a structure for a body of knowledge. The next step posited by Anderson was the development of curriculum materials covering the identified content. While Anderson's proposal might be impossible of accomplishment, it should be more promising than an attempt to begin anew in the preparation of yet another curriculum approach. The pooled experiences of the leaders in the curriculum work which has been done should provide a foundation for the identification of mutually acceptable content, structure, and materials.

On the other hand, Feirer (1969) has cautioned that change in educational practice comes about very slowly, and is seldom revolutionary in character. He suggested that the most likely implementation of new ideas would occur as those ideas are used to enrich the traditional industrial arts program. In addition, he emphasized the primacy of the teacher education programs if curriculum change is to be effected; this requires well informed and involved teacher educators who prepare innovative, forward-looking industrial arts teachers.

Implementation of curriculum change at the local level rests largely upon the processes of study, organization, implementation, and evaluation described by Maffett (1969). Individual teachers can select ideas and materials from among the various approaches to industrial arts curriculum development and synthesize their own eclectic approach. As Young (1970) indicated, such an approach requires a flexible, professional industrial arts teacher who does not feel threatened by the need for curriculum change and who is willing to withhold judgment on the effectiveness of an innova-

tion until ample time has elapsed for the new program to demonstrate its value in operation.

Carter (1970) advocated the establishment of a common core of learning experiences for industrial arts, but cautioned that the implementation of curriculum reform should be based upon existing programs. He stressed the need for effective communication among all groups involved, but suggested that any national guidelines avoid prescription and maintain freedom for local flexibility and innovation.

Funding

Funding has been both a problem and a blessing for industrial arts curriculum research. For many years, no money was available; no effective curriculum development activities could be financed except from instructional budgets. As limited funding became available, curriculum activities were stimulated. However, the cultivation and nurturing of a grant requires an inordinate amount of administrative effort which reduces the professional energies available for the creative curriculum improvement processes. To complicate the matter, funding agencies sometimes appear to be fickle in their funding priorities, and industrial arts has not managed to remain in clear focus over extended periods of time.

Continuity of funding is critical in curriculum development endeavors. To conduct a funded project, one must formulate a proposal, obtain funding, negotiate a contract, select staff, organize the efforts of a group of professionals from the requisite specialties, develop materials, conduct the necessary field studies, revise, disseminate, and publish materials, prepare teachers, and respond to inquiries. This simply cannot be done effectively without some assurance that funding will be continuous and long-term.

The history of funding of curriculum endeavors parallels that which has plagued educational research attempts in recent years. There is usually less money granted than was originally requested, and the grant frequently is not approved until after it was scheduled to begin. The investigator is held to the original time schedule, despite restricted funds and the lack of time allocated for "tooling-up" and completing the project activities.

Interdisciplinary Involvement

Industrial arts curriculum projects have not tended to work closely with curriculum development efforts in other school subjects, even when these have been highly relevant. In fact, there is relatively little interdisciplinary work being conducted in any of the school subject areas. One important project which has been completely ignored in the industrial arts curriculum literature, so far as this reviewer can determine, is the Engineering Concepts Curriculum Project (ECCP), which seeks to develop technological literacy through some excellent programs for high school students. To date, a three-part textbook (ECCP, 1968a; 1968b; 1969) has been prepared, accompanied by a laboratory manual (ECCP, 1968c). While the material is rather technical and engineering-oriented, it should be

highly valuable in advanced industrial arts programs for academically talented students.

In contrast, the work of Darcy and Powell (1968a; 1968b) in organizing an economics program has been utilized by one of the projects reviewed herein: the Career Development for Children Project. While some adaptations remain to be made in this instance to prepare usable materials, it would appear to be highly desirable for industrial arts to capitalize upon such developments. Closer cooperation with curriculum investigators in other fields could yield an infinitely greater return on the investment in human effort.

The relationships between industrial arts and vocational trade and industrial education are a source of continuing concern. The American Vocational Association provided a list of the unique characteristics of the two fields, comparing their curriculums, schools, teachers, facilities, and students (Robertson, 1967). Lathrop and Farr (1968) studied the close relationships between the two fields in California and made recommendations for their improvement.

Evans (1970) called for cooperation between industrial arts and vocational education in the provision of needed occupational programs. London (1970) emphasized the role industrial arts should play in preparing students for entrance into vocational programs. Swanson, Wright, and Halfin (1970) suggested that occupational purposes provide an effective focus for the variety of purposes of industrial arts. Lux (1970) held that industrial arts should consider occupational goals equally important with other goals of education: technical, recreational, consumer, cultural, and social.

Instructional Materials

There is a wide range of specificity apparent in the curriculum recommendations for industrial arts education. Some writers present a highly philosophical set of guidelines, but provide few guides for practical implementation. In these instances, the industrial arts teacher is exhorted to apply a set of principles to the selection of content and activities for his courses. He should then proceed to develop the necessary instructional materials and present them within the frame of reference advocated by the curriculum theorist. Other groups have developed illustrative materials or sample sets of instructional materials which can be used in some units or some courses. These project-prepared materials are then supposed to serve as examples for the development of additional materials by the teacher (who presumably has more time for such things than the curriculum researcher). At the other extreme, the Industrial Arts Curriculum Project has developed commercially available text materials, laboratory manuals, and teacher's guides for two years of instruction. These developmental activities have been supplemented by in-service and preservice teacher education, workshops, and widespread dissemination activities.

A wealth of excellent curriculum material has been developed as a concomitant outcome of a variety of endeavors in industrial arts education. In addition to the curriculum development projects which have been re-

viewed, many institute programs and state-sponsored groups have generated materials. It is unfortunate that no organized way has been developed to disseminate them more widely. An excellent series of 21 resource units accompanied the report submitted by Hastings, *et al.*, (1967) on an innovative undergraduate industrial arts teacher education program. Other institutes have produced outstanding materials as a part of their activities, yet they have seldom published or disseminated their products beyond the participants in the programs. Similarly, state curriculum guides are rarely used in other states and are not effectively implemented in the states of their origin.

PRIORITIES FOR RESEARCH, DEVELOPMENT, AND DISSEMINATION

Before closing this paper, the reviewer feels compelled to offer a few suggestions for future activities which might be directed toward identifiable needs in the area of industrial arts curriculum development. While these are not in a specific order or urgency, they do represent problem areas which deserve attention if the rate of progress in curriculum development is to be retained and accelerated.

Research

There is still no identifiable body of knowledge on effective teaching in industrial arts subjects. The role of manipulative activities, the development of conceptual understandings, the effects of vicarious experiences, and environmental-personality interactions represent examples of problems in this area. Kreuter and Barnett (1967) presented an unusual analysis of the problem of teaching effectively about industry in the classroom. Through abstraction, reduction, and distortion, educational content is seriously misrepresented in what they term the "relevancy-filtration process." For example, the real-world term, "factory," is included in a curriculum plan, which is used in the preparation of a textbook, which serves as a guide in the preparation of a course of study, which is used by a teacher in a classroom to teach what a factory is. Research is needed to tell educators what is really going on in the educational process and how to modify the procedures to obtain the desired results.

Information is needed on the characteristics of the learner at all age levels served by industrial arts. Relatively little has been done to establish the appropriateness of industrial arts content and activities at any grade level. There is an ever present danger that the work which looks so good to the industrial arts specialist may be inappropriate for learners, or that it may be potentially harmful to individuals who exhibit certain personality traits.

The body of knowledge upon which industrial arts courses is based has not yet been fully defined, categorized, and communicated. Additional efforts should be devoted to the analysis and definition of the discipline base, with concomitant efforts designed to clarify terminology and establish more generally acceptable definitions of terms.

One of the most obvious needs for research is in the realm of comparative studies. There is still very little evidence to convince any educator to implement any of the curriculum proposals yet available. The primary appeal of all curriculum proposals, projects, publications, and efforts in industrial arts has been a logical, rational, or emotional appeal to adopt the recommended approach. Only a few developmental efforts have obtained ongoing performance data on their implementation endeavor. Even in these instances, it has not been possible to contrast the results with those which would have been obtained from another innovative approach.

What is urgently needed is a series of carefully designed, well controlled experimental studies comparing the effectiveness of the various curriculum developmental efforts. Since relatively few projects have materials or approaches ready for implementation, the experimental task should be manageable.

Research is also needed in the area of educational change. It would be most helpful if educators knew which variables were critical to the acceptance of an innovation and how to proceed to effect change with a minimum of opposition. The failure of some promising innovations to achieve widespread acceptance could perhaps be attributed to difficulties in attaining changes rather than to intrinsic weaknesses in the program.

Development

A major priority for development activities relevant to industrial arts curriculum should be allocated to a concerted effort to arrive at guidelines which can be generally accepted or utilized by a majority of the profession. Perhaps the suggestions of Anderson (1970) could serve to inaugurate such an enterprise. The lack of clearly stated and accepted goals, objectives, guidelines for content and activity selection, and a common terminology restricts the effectiveness of much outstanding work.

The management of a major program of industrial arts curriculum development is a substantial task. It diverts the energies and efforts of professionals from developmental activities to project management. Schmitt (1970) analyzed the project director's task. He recommended the use of systems analysis to develop an appropriate structure for organizing and operating the project, for communications, and for project evaluation. His recommendations could serve as a base for further development to prepare a cadre of professionals for service in project management.

Some priority should be given to increasing the comprehensiveness of industrial arts curriculum development approaches. It is imperative that learners at all levels be considered and that the relationship of industrial arts instruction to the remainder of the school program be taken into account. While it may be unreasonable to expect one project to be so grandiose as to encompass all of industrial arts and relate it to all of education, attempts should be made to improve correlation and integration in every possible way. Perhaps a consortium of projects should undertake closely coordinated efforts which could reinforce each other and work toward a more comprehensive goal—the improvement of all industrial arts instruction.

The development of innovative teacher education programs should accompany or precede curriculum development activities for the elementary and secondary schools. Teacher education has probably tended to remain even more tradition-bound than the school programs; this condition must be changed to provide leadership for change at the local level. Similarly, teacher education programs should be modified as necessary to prepare industrial arts teachers to implement and participate in curriculum innovation. Ray and Streichler (1971) have recently presented a major work on

content and methodology in industrial arts teacher education. It should serve as a primary resource for the improvement of industrial arts teacher education in the years ahead.

Dissemination

Commercial publication of curriculum materials should be encouraged as soon as materials have been field tested and revised to attain a reasonable level of applicability. Without commercial availability, no effective way has been found to provide for ready utilization of new materials.

Both in-service and preservice teacher education should be a part of curriculum dissemination efforts. In addition to teacher education programs related to one curriculum position, eclectic approaches to dissemination should also be considered.

Curriculum developers and supervisors should not become discouraged at the apparently slow rate of acceptance of their innovations. Jahns and Gendron (1970) pointed out the need for teachers to have relevant, innovative materials available for some time before they utilized them. Rewards for innovation have not been great in most educational settings.

BIBLIOGRAPHY[1]

(Boldface numbers indicate pages which cite the references)

Alexander, William F. "A Concept of Transportation for Industrial Arts." *The Journal of Industrial Arts Education,* Vol. 29 (May-June, 1970), pp. 12-17. **22**

American Council of Industrial Arts Supervisors. *Industrial Arts Education.* Washington, D.C.: American Industrial Arts Association, 1963. **6**

———. *Industrial Arts Education.* Revised Edition. Washington, D.C.: American Industrial Arts Association, 1969. **6**

American Industrial Arts Association. *Industrial Arts and Technology—Past, Present, and Future: Addresses and Proceedings of the 29th Annual Convention at Philadelphia.* Washington, D.C.: The American Industrial Arts Association, 1967. (ED 021 968 MF $0.65 HC not available from EDRS) **10**

———. *Man, Society, Technology: Representative Addresses and Proceedings of the 32nd Annual Convention at Louisville.* Washington, D.C.: American Industrial Arts Association, 1970. **10**

———. *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the American Industrial Arts Association's 30th Annual Convention at Minneapolis.* Washington, D.C.: American Industrial Arts Association, 1968. **10**

———. *New Directions for Industrial Arts: Addresses and Proceedings of the 26th Annual Convention of the American Industrial Arts Association, Washington, 1964.* Washington, D.C.: American Industrial Arts Association, 1964. 193 pp. (ED 019 466 MF $0.65 HC not available from EDRS) **10**

———. *The New Industrial Arts Curriculum.* Newark, New Jersey: American Industrial Arts Association, 1947. **6**

American Vocational Association. *A Guide to Improving Instruction in Industrial Arts.* Washington, D. C.: American Vocational Association, 1955. **6**

———. *A Guide to Improving Instruction in Industrial Arts, A Revision.* Washington, D.C.: American Vocational Association, 1968. 63 pp. (ED 024 814 MF $0.65 HC $3.29) **16**

———. *Improving Instruction in Industrial Arts.* Washington, D.C.: American Vocational Association, 1948. **6**

———. *Standards of Attainment in Industrial Arts.* Washington, D.C.: American Vocational Association, 1934. **6**

[1] Bibliographical entries followed by an ED or MP number in parenthesis are generally available in hard copy or microfiche through the Educational Resources Information Center (ERIC). This availability is indicated by the abbreviations, MF for microfiche and HC for hard copy. Order from ERIC Document Reproduction Service, P. O. Drawer O, Bethesda, Maryland 20014. Payment must accompany orders totaling less than $10.00.

Anderson, Herbert A. "A National Industrial Arts Curriculum—To Be or Not to Be." *Journal of Industrial Teacher Education,* Vol. 7 (Winter, 1970), pp. 32-35. **39,44**

Anderson, Herbert A., and Olstad, Harry. "American Industry—A New Direction for Industrial Arts." *Man/Society/Technology,* Vol. 30 (May-June, 1971), pp. 246-267. **14, 15, 16**

Bailey, Larry J. "Career Development at the Elementary School Level." Paper presented at American Industrial Arts Association Convention, April 23, 1971. (a) **31**

_____. *A Curriculum Model for Facilitating Career Development.* Carbondale, Illinois: Southern Illinois University, 1971. (b) **30**

_____, ed. *Facilitating Career Development: An Annotated Bibliography.* Final Report. Springfield, Illinois: Illinois State Board of Vocational Education and Rehabilitation; and Carbondale, Illinois: Southern Illinois University, 1970. 137 pp. (ED 042 217 MF $0.65 HC $6.58) **30**

Barella, Richard V.; Buchanan, Glen G.; and Stoper, Richard L. "A Study of Manufacturing Industries." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D.C.: American Industrial Arts Association, 1968. pp. 249-250. **17**

Barella, Richard V., and Stoper, Richard L. "The Parma Approach—Probing a New Orbit in Junior-High Industrial Arts." *School Shop,* Vol. 28 (February, 1969), pp. 45-48. **17**

Barlow, Melvin L. *History of Industrial Education in the United States.* Peoria, Illinois: Charles A. Bennett Co., 1967. **5**

Bateson, Willard M., and Stern, Jacob. "The Functions of Industry as the Basis for Industrial Education Programs." *Journal of Industrial Teacher Education,* Vol. 1 (Fall, 1963), pp. 3-16. **17**

_____. "Functions of Industry: Bases for Vocational Guidance." *School Shop,* Vol. 21 (March, 1962), pp. 7, 20, 22. **17**

Beam, H. E., and Clary, J. R. *Introduction to Vocations Teachers Guide.* Revised Edition. Raleigh, North Carolina: North Carolina Department of Public Instruction, 1968. **29, 30**

Bennett, Charles A. *History of Manual and Industrial Education up to 1870.* Peoria, Illinois: Charles A. Bennett Co., 1926. **5**

_____. *History of Manual and Industrial Education 1870 to 1917.* Peoria, Illinois: Charles A. Bennett Co., 1937. **5**

Berry, Arthur O. *Analysis of Selected Manufacturing Industries as a Basis for Course Content in Industrial Arts.* Doctoral thesis. Storrs, Connecticut: University of Connecticut, 1967. **13**

Blum, Robert E. "Field Testing the I.A.C.P. Teaching-Learning System." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D.C.: American Industrial Arts Association, 1968. pp. 227-233. **19**

Board of Education of the City of New York. *The Correlated Curriculum Project: A New Experimental Program for the General Student.* New York, New York: Ford Foundation, and Brooklyn, New York: City Board of Education, 1967. 6 pp. (ED 022 005 MF $0.65 HC $3.29) **29**

Bonser, Frederick G., and Mossman, Lois C. *Industrial Arts for Elementary Schools.* New York, New York: The Macmillan Co., 1923. **6**

Bradley, John G. "Teaching Industrial Arts in a Workaday World." *School Shop,* Vol. 30 (June, 1971), pp. 19-20, 29. **26**

Brown, Alan D., and Haney, George M. "Tailoring a Junior High for New Instructional Tactics." *School Shop,* Vol. 28 (April, 1969), pp. 100-103. **24**

Brown, George. "Industriology Philosophy." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1968. pp. 212-213. **33**

Brown, Walter C. "New Ways of Teaching Industrial Arts." *Industrial Arts and Vocational Education,* Vol. 58 (December, 1969), pp. 20-21, 50, 53. **10**

Buffer, James J., Jr. "Revising the I.A.C.P. Teaching-Learning System." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D.C.: American Industrial Arts Association, 1968. pp. 234-236. **19**

Carrel, Joseph J. "Reaction." *The Journal of Industrial Arts Education,* Vol. 29 (September-October, 1969), p. 18. **26**

Carter, P. John. *An Investigation of Attitudes Held by Industrial Arts Educators toward the Question of a Uniform Nationwide Curriculum for Industrial Arts.* Doctoral thesis. Greeley, Colorado: University of Northern Colorado, 1970. (ED 043 745 Document not available from EDRS) **40**

Clary, Joe R., and Beam, H. E. "Realistic Vocational Education for Ninth Graders." *American Vocational Journal,* Vol. 40 (May, 1965), pp. 16-17. **29**

Cochran, Leslie H. "Charting the Changing Directions of Industrial Education." *School Shop,* Vol. 29 (September, 1969), pp. 47-50. (a) **10**

———. "Charting the Changing Directions of Industrial Education." *School Shop,* Vol. 29 (October, 1969), pp. 53-56. (b) **10**

———. "A Closer Look at Selected Contemporary Programs in Industrial Education." *Journal of Industrial Teacher Education,* Vol. 7 (Winter, 1970), pp. 40-49. (a) **10**

_____. *A Comparison of Selected Contemporary Industrial Education Programs.* Doctoral thesis. Detroit, Michigan: Wayne State University, 1968. **9**

_____. "Innovation: A New Direction for Industrial Education." *Industrial Arts and Vocational Education,* Vol. 58 (December, 1969), pp. 22-24. (c) **10**

_____. *Innovative Programs in Industrial Education.* Bloomington, Illinois: McKnight & McKnight Publishing Co., 1970. (b) **10, 11, 27, 28, 34**

Correlated and Pre-Technical Programs. *The Pre-Technical Project, A Demonstration in Education for Technology. Engineering Technology, 11th and 12th Year.* New York, New York: New York City Board of Education, 1967. **29**

Cox, Walter L.; Clary, Joe R.; and Duncan, Jack A. "I. V. Moves Ahead." *American Vocational Journal,* Vol. 42 (October, 1967), pp. 30-31. **30**

Darcy, Robert L., and Powell, Phillip E. *Manpower and Economic Education.* Revised Edition. New York, New York: Joint Council on Economic Education, 1968. (a) **31, 41**

_____. *Manpower and Economic Education Teacher Manual.* New York, New York: Joint Council on Economic Education, 1968. (b) **31, 41**

Davison, William W. "Galaxy Plan in a Rural High School." *Where the Action Is: Selected Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (31st, Las Vegas). Washington, D. C.: American Industrial Arts Association, 1969. pp. 133-134. (ED 038 544 MF $0.65 HC not available from EDRS) **28**

DeVore, Paul W. "Curricular Considerations, Oswego." *Industrial Arts and Technology Past, Present, and Future; Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D. C.: American Industrial Arts Association, 1967. pp. 12-18. (ED 021 968 MF $0.65 HC not available from EDRS) (a) **22**

_____. *Curriculum Focus: Occupations and the World of Work.* Morgantown, West Virginia: West Virginia University, 1969. **22**

_____. "Discipline Structures and Processes: A Research Design for the Identification of Content and Method." *Journal of Industrial Teacher Education,* Vol. 7 (Winter, 1970), pp. 21-31. (a) **21, 22**

_____. "Knowledge—Technology and Curriculum." *Industrial Arts and Technology Past, Present, and Future: Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D. C.: American Industrial Arts Association, 1967. pp. 41-54. (ED 021 968 MF $0.65 HC not available from EDRS) (b) **22**

_____. *Structure and Content Foundations for Curriculum Development.* Washington, D. C.: American Industrial Arts Association, 1966. 24 pp. (ED 020 429 MF $0.65 HC not available from EDRS)

_____. "Preparing People for the World of Work." *The Journal of Industrial Arts Education,* Vol. 29 (March-April, 1970), pp. 22-28. (c) **26**

_____. *Technology—An Intellectual Discipline.* Washington, D. C.: American Industrial Arts Association, 1964.

_____. "Transportation Technology: The Identification of Content and Method." *The Journal of Industrial Arts Education,* Vol. 29 (May-June, 1970), pp. 18-22. (b) **22**

Diehl, William F., and Kreuger, Walter C. "Let's Move with Power Technology." *School Shop,* Vol. 29 (March, 1970), pp. 45-46, 76. **36**

Dispensa, Joseph, Jr. "Effecting Change through the Elementary Classroom Teacher: Classroom Phase." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1968. pp. 260-261. **25**

Drost, Walter H. *David Snedden and Education for Social Efficiency.* Madison, Wisconsin: University of Wisconsin Press, 1967. **6**

Duffy, Joseph W. "Conceptualizing the Functions of Industry." *The Journal of Industrial Arts Education,* Vol. 29 (March-April, 1970), pp. 10-17. **17**

Duncan, Jack A. "Introduction to Vocations." *American Vocational Journal,* Vol. 41 (October, 1966), pp. 34-36. **30**

Duvall, Jack T.; Ellison, Owen F.; and Slobodian, Dmitri. "Diesel Programs for Industrial Arts." *Industrial Arts and Vocational Education,* Vol. 58 (May, 1969), pp. 33-37. **36**

Egan, Edward M. *A Study of Student Attitudes in American Industry.* Master's thesis. Menomonie, Wisconsin: Stout State University, 1966. **15**

Engineering Concepts Curriculum Project. *The Man Made World Part One.* New York, New York: McGraw-Hill, Inc., 1969. **40**

_____. *The Man Made World Part Two.* New York, New York: McGraw-Hill, Inc., 1968. (a) **40**

_____. *The Man Made World Part Three.* New York, New York: McGraw-Hill, Inc., 1968. (b) **40**

_____. *The Man Made World Laboratory Manual.* New York, New York: McGraw-Hill, Inc., 1968. (c) **40**

Evans, Rupert N. "How to Live with Change without Being Corrupted by Money." *Theory Into Practice,* Vol. 9 (December, 1970), pp. 280-283. **41**

Face, Wesley L. "The American Industry Project." *Industrial Arts and Technology Past, Present, and Future: Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D. C.: American Industrial Arts Association, 1967. pp. 18-19. (ED 021 968 MF $0.65 HC not available from EDRS) **15**

———., and Flug, Eugene R. "A Conceptual Approach to the Study of American Industry." *Developing Human Potential through Industrial Arts, Addresses and Proceedings of the Annual Convention of the American Industrial Arts Association* (27th, Tulsa, 1965). Washington, D. C.: American Industrial Arts Association, 1965. pp. 115-119. (ED 017 678 MF $0.65 HC not available from EDRS) **14, 15**

———. *Development of a Conceptual Framework for the Teaching of Industrial Arts.* Menomonie, Wisconsin: Stout State University, 1965. 76 pp. (ED 003 847 MF $0.65 HC $3.29) (b) **14**

Feirer, John L. "The Future of Innovative Programs in Industrial Arts." *Industrial Arts and Vocational Education,* Vol. 58 (December, 1969), p. 19. **39**

———, and Lindbeck, John R. *Industrial Arts Education.* Washington, D. C.: Center for Applied Research in Education, 1964. **56**

Ford Foundation. *Ford Foundation Grants in Vocational Education.* Revised Edition. New York, New York: The Ford Foundation, 1967. 36 pp. (ED 019 524 MF $0.65 HC $3.29) **10**

Gallagher, James E. "A New Concept of Interpreting Productive Society to Youth—A Description of the Ziel Program of Industrial Arts." *New Directions for Industrial Arts, Addresses and Proceedings of the Annual Convention of the American Industrial Arts Association* (26th, Washington, 1964). Washington, D. C.: American Industrial Arts Association, 1964. pp. 70-72. (ED 019 466 MF $0.65 HC not available from EDRS) **13**

———, *et al.* "A Systems Approach for a Productive Society." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1968. pp. 247-249. **13, 14**

Gebhart, Richard H. *Developing American Industry Courses for the Secondary School.* Menomonie, Wisconsin: Stout State University, 1968. 33 pp. (ED 031 594 MF $0.65 HC $3.29) **14**

Hacker, Michael. "A Seventh-Grade Industrial Arts Curriculum." *Man, Society, Technology: Representative Addresses and Proceedings of the 32nd Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1970. pp. 317-320. **17**

———. "The Syosset Plan: Seventh Grade Manufacturing." *Industrial Arts and Vocational Education,* Vol. 58 (January, 1969), pp. 24-25. **17**

Hackett, Donald F. "Man, Technology, and Manufacturing." *Man, Society, Technology: Representative Addresses and Proceedings of the 32nd Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1970. pp. 309-314. **34**

———. "Study of American Industry is Essential to Liberalizing General Education." *Industrial Arts and Vocational Education,* Vol. 53 (April, 1964), pp. 25-28, 70. **34**

Hastings, James R., *et al. Field Study in Industry for the Preparation of Industrial Arts Teachers. Final Report, Volume 1.* Oswego, New York: State University of New York, 1967. 506 pp. (ED 018 670 MF $0.65 HC $19.14) **42**

Hauenstein, A. Dean. "Developing I.A.C.P. Teaching-Learning Experiences and Materials." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D.C.: American Industrial Arts Association, 1968. pp.236-238. **19**

Householder, Daniel L., and Suess, Alan R. *Review and Synthesis of Research in Industrial Arts Education.* Research Series No. 42. Columbus, Ohio: The Center for Vocational and Technical Education, The Ohio State University, 1969. 69 pp. (ED 034 898 MF $0.65 HC $3.29) **10**

Hunt, Elizabeth E. "The Institute of Technology for Children." *Industrial Arts and Technology Past, Present, and Future: Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D.C.: American Industrial Arts Association, 1967. pp. 224-229. (ED 021 968 MF $0.65 HC not available from EDRS) **24**

———. "Technology for Change in Elementary Schools." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1968. pp. 253-356. **25**

Industrial Arts and Vocational Education. "Roundtable: Comparing Programs in Industrial Education." *Industrial Arts and Vocational Education,* Vol. 59 (January, 1970), pp. 24-26, 68-69. **9, 17, 27, 28**

Jackman, Duane A. "Industriology for the Elementary School." *Man, Society, Technology: Representative Addresses and Proceedings of the 32nd Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1970. pp. 325-327. **34**

———. "Industriology Structure." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1968. pp. 213-214. **33**

Jahns, Irwin R., and Gendron, Ernest G. "Factors Affecting Teacher Innovativeness and the Diffusion of an Educational Innovation." *Vocational-Technical Education in Human Resource Development in Florida: A State-wide Evaluation.* Edited by H. P. Kraft and Lawrence Weisman. Tallahassee, Florida: Florida Department of Education, 1970. pp. 58-66. **45**

Johnson, Delton L. *State Handbooks for Industrial Arts: A Comparison of Content with Judgments of Leaders and an Examination of Trends Reflected in These Publications.* Doctoral thesis. Fayetteville, Arkansas: University of Arkansas, 1969. 219 pp. (ED 028 269 Document not available from EDRS) **35**

Kabakjian, Edward. "A Role to Play in Manpower Development." *The Journal of Industrial Arts Education,* Vol. 29 (March-April, 1970), pp. 36-39. **26**

Kicklighter, Clois E. *An Exploratory Taxonomy Based on the Common Elements of Industrial Enterprises for Industrial Arts Content Identification.* Doctoral thesis. University Park, Maryland: University of Maryland, 1966. **13**

Kirby, Jack. "Industriology Activities." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1968. pp. 214-215. **33**

Koonce, Tommy R. *State Prepared Industrial Arts Resource Material: Their Status, Preparation, and Effectiveness.* Doctoral thesis. Columbia, Missouri: University of Missouri, 1968. 134 pp. (ED 025 621 Document not available from EDRS) **35**

Kreuter, Mortimer, and Barnett, Lawrence J. *Curriculum Relevancy and Work.* New York, New York: Center for Urban Education, 1967. 20 pp. (ED 020 311 MF $0.65 HC $3.29) **43**

Lathrop, Irvin, and Farr, Wilbur. *Relationship of Industrial Arts Education to Vocational Trade-Technical Education in California; A Survey Report.* Long Beach, California: California State College; and Sacramento, California: Bureau of Industrial Education, California State Department of Education, 1968. 110 pp. (ED 024 811 MF $0.65 HC $6.58) **41**

Lauda, Donald P. "Industrial Arts and Work: Two Concepts in Question." *The Journal of Industrial Arts Education,* Vol. 29 (March-April, 1970), pp. 18-21. **21**

_____. "In the Midst of Change." *The Journal of Industrial Arts Education,* Vol. 29 (September-October, 1969), pp. 32-34. **21**

London, H. H. "The Place and Function of Industrial Arts in Preparing Youth for the World of Work." *Theory Into Practice,* Vol. 9 (December, 1970), pp. 294-297. **41**

Lux, Donald G. "A Call for Action." *Theory Into Practice,* Vol. 9 (December, 1970), pp. 309-312. **41**

_____. "Philosophical Bases of Industrial Arts—Four Poles?" *Industrial Arts and Technology Past, Present, and Future: Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D. C.: American Industrial Arts Association, 1967. pp. 10-12. (ED 021 968 MF $0.65 HC not available from EDRS) **19**

_____. "Think Twice about Jumping Aboard the Vocational-Education Bandwagon." *School Shop,* Vol. 30 (February, 1971), pp. 43-44, 72. **26**

_____, and Ray, Willis E. "The Industrial Arts Curriculum Project." *American Vocational Journal,* Vol. 44 (March, 1969), pp. 61-62. **19**

_____. "Toward a Knowledge Base for Practical Arts and Vocational Education." *Theory Into Practice,* Vol. 9 (December, 1970), pp. 301-308. **18, 19**

_____, and Hauenstein, A. Dean. *The World of Construction.* Fourth Edition. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1970. (a) **20**

———. *The World of Construction Laboratory Manual Semester 1.* Fourth Edition. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1970. (b) **20**

———. *The World of Construction Laboratory Manual Semester 2.* Fourth Edition. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1970. (c) **20**

———. *The World of Construction Teacher's Guide.* Fourth Edition. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1970. (d) **20**

———. *The World of Manufacturing.* Fourth Edition. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1971. (a) **20**

———. *The World of Manufacturing Laboratory Manual.* Fourth Edition. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1971. (b) **20**

———. *The World of Manufacturing Teacher's Guide.* Fourth Edition. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1971. (c) **20**

Maffett, Ronald D. "It Can be Done." *The Journal of Industrial Arts Education,* Vol. 29 (September-October, 1969), pp. 10-12. **39**

Mahoney, James H. *State Instructional Materials in Industrial Arts: Their Status, Content, Preparation and Use.* Doctoral thesis. Columbia, Missouri: University of Missouri, 1956. **35**

Maley, Donald. "Industrial Arts—A Study of Industry and Technology for Contemporary Man." *Industrial Arts and Technology Past, Present, and Future: Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D.C.: American Industrial Arts Association, 1967. pp. 5-10. (ED 021 968 MF $0.65 HC not available from EDRS) (a) **23**

———. "Into the Mainstream." *American Vocational Journal,* Vol. 45 (February, 1970), pp. 42-44, 83. (b) **24**

———. "The Junior High School Program in Industrial Arts, A Study of Industry and Technology for Contemporary Man." *Industrial Arts and Technology Past, Present, and Future: Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D. C.: American Industrial Arts Association, 1967. pp. 38-41. (ED 021 968 MF $0.65 HC not available from EDRS) (b) **23**

———. "The Maryland Plan and the Behavioral Task Analysis Approach." *Where the Action Is: Selected Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (31st, Las Vegas). Washington, D. C.: American Industrial Arts Association, 1969. pp. 93-106. (ED 038 544 MF $0.65 HC not available from EDRS) **23**

———. "A New Role for Industrial Arts in the Senior High School." *School Shop,* Vol. 29 (March, 1970), pp. 41-44, 65. (a) **24**

Marland, Sidney P., Jr. "Career Education Now." *School Shop,* Vol. 30 (May, 1971), pp. 27-28, 43. (ED 048 480) **26**

Mason, Emmett E. *The Associative Meaning and Content Validity of Selected Elements from the Industrial Arts Curriculum Project's Taxonomy as Determined by Continued Word Association.* Doctoral thesis. Columbus, Ohio: The Ohio State University, 1969. **19**

McLea, Kenneth R. "Implementation of the Galaxy Plan in an Inner-City High School." *Where the Action Is: Selected Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (31st, Las Vagas). Washington, D. C.: American Industrial Arts Association, 1969. pp. 129-133. (ED 038 544 MF $0.65 HC not available from EDRS) **28**

Minelli, Ernest L. *The Partnership Vocational Education Project, A New Program in Industrial-Technical Education.* Mount Pleasant, Michigan: Central Michigan University, 1965. 17 pp. (ED 012 313 MF $0.65 HC $3.29) **27**

———. "The Partnership Vocational Education Project: Pertinent Impressions." *Man, Society, Technology: Representative Addresses and Proceedings of the 32nd Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1970. pp. 169-171. **27**

Nelson, Howard F. "Which Way Industrial Arts in the '70s?" *School Shop,* Vol. 30 (December, 1970), pp. 35-36. **26**

Nelson, Orville W. *The American Industry Project: Development and Evaluation.* Menomonie, Wisconsin: Stout State University, 1967. **15**

———. *The Evaluation System for the American Industry Secondary School Courses.* Menomonie, Wisconsin: Stout State University, 1968. 37 pp. (ED 030 715 MF $0.65 HC $3.29) **15**

New England Regional Commission and New England School Development Council Tri-State Vocational Project. *Exploring Occupations.* East Montpelier, Vermont: Tri-State Vocational Project, n.d. **30**

Nystrom, Dennis C. "A Broader Mission for Industrial Arts." *American Vocational Journal,* Vol. 44 (October, 1969), pp. 52-54. **16**

Olson, Delmar W. *Industrial Arts and Technology.* Englewood Cliffs, New Jersey: Prentice-Hall, 1963. **7, 21**

———. "Industrial Arts and Technology." *Symposium on Industrial Arts Education, 1968.* Paper presented at California Symposiums on Industrial Arts Education, July 8-12, 1968. 22 pp. (ED 027 408 MF $0.65 HC $3.29) **21**

———. "Reaction." *The Journal of Industrial Arts Education,* Vol. 29 (September-October, 1969), pp. 18-20. **26**

———. *Technology and Industrial Arts: A Derivation of Subject Matter from Technology, with Implications for the Industrial Arts Program.* Doctoral thesis. Columbus, Ohio: The Ohio State University, 1957. **21**

O'Neill, John. "Instructional Media Support." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D. C.: American Industrial Arts Association, 1968. pp. 215-216. **33**

Peter, Richard F., *et al.* "The Industrial Arts Curriculum Project: A Progress Report to the Profession." *The Journal of Industrial Arts Education,* Vol. 29 (November-December, 1969), pp. 10-40. **19**

Pragmateian. "The Impact of Industriology." *Pragmateian,* Vol. 6 (April, 1971), p. 2 **34**

Pratzner, Frank C. "Changing the Goals of Industrial Arts: An Occupational Development Curriculum." *Journal of Industrial Teacher Education,* Vol. 6 (Winter, 1969), pp. 31-40. **25**

Ray, Willis E., and Streichler, Jerry, eds. *Components of Teacher Education.* 20th Yearbook, American Council on Industrial Arts Teacher Education. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1971. **44**

Risher, Charles G. "Applied Power does Things Faster: A Rationale for Power Instruction." *Industrial Arts and Vocational Education,* Vol. 58 (January, 1969), pp. 28-29. **36**

Robertson, Von H., ed. *Guidelines for the Seventies.* 1967 Yearbook, Trade and Industrial Division, American Vocational Association. Chicago, Illinois: American Technical Society, 1967. **41**

Robinson, Ward R. "A Step to Career Planning through Introduction to Vocations." *North Carolina Parent-Teacher Bulletin,* (November, 1968), pp. 16-17. **30**

Salomon, Otto. *The Theory of Educational Sloyd.* Morristown, New Jersey: Silver Burdett, 1896. **5**

Schmitt, Marshall L. *Improving Industrial Arts Teaching.* Washington, D.C.: U.S. Office of Education, 1962. 70 pp. (ED 001 211 MF $0.65 HC $3.29) **6**

_____. "Managing Large-Scale Federally Supported Industrial Arts Projects." *Industrial Arts and Vocational Education,* Vol. 59 (May-June, 1970) pp. 20-22, 24-25. **44**

_____, and Pelley, Albert L. *Industrial Arts Education.* Washington, D.C.: U.S. Office of Education, 1966. **7**

Schwalm, Ray A. *VICOED: Visual Communications Education Pilot Program.* Bellingham, Washington: Western Washington State College, 1967. **36**

Sedgwick, Lorry K. *Teacher Education Program for American Industry: A Model and a Curriculum.* Menomonie, Wisconsin: Stout State University, 1966. **15**

Smith, Garrison B., *et al. The Pre-Technology Program, A Descriptive Report.* San Francisco, California: Cogswell Polytechnical College, 1966. 86 pp. (ED 016 047 MF $0.65 HC $3.29) **29**

Stadt, Ronald W., *et al.* "Enterprise: Man and Technology." *Industrial Arts and Vocational Education,* Vol. 58 (September, 1969), pp. 24-26. (a) **16**

———. "Enterprise: Man and Technology." *Industrial Arts and Vocational Education,* Vol. 58 (October, 1969), pp. 23, 61-66. (b) **16**

Starkweather, Kendall N. "A Future Oriented Industrial-Arts Program." *School Shop*, Vol. 30 (October, 1970), pp. 55-58, 86. **24**

State Committee on Coordination and Development. *A Prospectus for Industrial Arts in Ohio*. Columbus, Ohio: Ohio Education Association and State Department of Education, 1934. **6**

Stern, Jacob. *The Functions of Goods-Producing Industrial Establishments: A Validation of Selected Elements in a Definition of Industry as a Framework for Curriculum in Industrial Education*. Doctoral thesis. Detroit, Michigan: Wayne State University, 1964. **17**

Streichler, Jerry. "Curriculum Concepts and Courses: Directions for Teacher Educators." *The Journal of Industrial Arts Education,* Vol. 29 (January-February, 1970), pp. 29-32. **9**

———. *Review and Synthesis of Research in Industrial Arts Education.* Columbus, Ohio: The Center for Vocational and Technical Education, The Ohio State University, 1966. 102 pp. (ED 011 564 MF $0.65 HC $6.58) **9**

Stunard, E. Arthur. "Effecting Change through the Elementary Classroom Teacher: Institute Phase." *New Concepts in Industrial Arts: Selected Addresses and Proceedings of the 30th Annual Convention.* Washington, D.C.: American Industrial Arts Association, 1968. pp. 257-260. **25**

Suess, Alan R. "New Directions for Industrial Arts?" *Industrial Arts and Technology Past, Present, and Future: Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (29th, Philadelphia, 1967). Washington, D.C.: American Industrial Arts Association, 1967. pp. 274-275. (ED 021 968 MF $0.65 HC not available from EDRS) **37**

Sullivan, James A. "Industrial Arts as Enterprise." *Occupational Education Quarterly,* Vol. 3 (Spring, 1971), pp. 1-5. **16**

Super, D. E., and Overstreet, Phoebe L. *The Vocational Maturity of Ninth Grade Boys*. New York, New York: Teachers College, Columbia University, 1960. **29**

Swanson, Robert S. "Industrial Arts—What is its Body of Knowledge?" *Approaches and Procedures in Industrial Arts.* Edited by G. S. Wall. 14th Yearbook, American Council on Industrial Arts Teacher Education. Bloomington, Illinois: McKnight & McKnight Publishing Co., 1965. pp. 46-59. **11**

———; Wright, L. S.; and Halfin, Harold. "Occupational Education: A Means of Focusing Industrial Arts." *Theory Into Practice,* Vol. 9 (December, 1970), pp. 298-300. **41**

Taxis, Linda A., ed. *Where the Action Is: Selected Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (31st, Las Vegas). Washington, D.C.: American Industrial Arts Association, 1969. 334 pp. (ED 038 544 MF $0.65 HC not available from EDRS) **10**

Towers, Edward R.; Lux, Donald G.; and Ray, Willis E. *A Rationale and Structure for Industrial Arts Subject Matter.* Columbus, Ohio: The Ohio State University; and Champaign, Illinois: University of Illinois, 1963. 382 pp. (ED 013 955 MF $0.65 HC $13.16) **18, 19**

Venn, Grant. "On Industrial Arts and Vocational Education." *The Journal of Industrial Arts Education,* Vol. 29 (September-October, 1969), pp. 14-18. **26**

Wisconsin State University. *Development and Structure of Industry: Information and Job Sheets.* Platteville, Wisconsin: College of Industry, Wisconsin State University, n.d. (ED 037 554 MF $0.65 HC $6.58) (b) **33**

_____ . *Development and Structure of Industry: Instructional Aids List and Bibliography.* Platteville, Wisconsin: College of Industry, Wisconsin State University, n.d. (ED 037 557 MF $0.65 HC $3.29) (c) **33**

_____ . *Development and Structure of Industry: Study Guide.* Platteville, Wisconsin: College of Industry, Wisconsin State University, n.d. (ED 037 556 MF $0.65 HC $6.58) (d) **33**

_____ . *Development and Structure of Industry: Teaching Plan and Activity Plan Sheets.* Platteville, Wisconsin: College of Industry, Wisconsin State University, n.d. (ED 037 555 MF $0.65 HC $3.29) (e) **33**

_____ . *Industriology—The Science of Industry.* Platteville, Wisconsin: Wisconsin State University, n.d. (a) **33**

Woodward, Calvin M. *Manual Training in Education.* New York, New York: Scribners and Welford, 1890. **6**

Woodward, Robert L. "Reaction." *The Journal of Industrial Arts Education.* Vol. 29 (September-October, 1969). p. 20. **26**

Yoho, Lewis W. *The "Orchestrated System" Approach to Industrial Education (Industrial Arts—Technical—Vocational).* Terre Haute, Indiana: Indiana State University, 1967. 16 pp. (ED 020 317 MF $0.65 HC $3.29) **20**

_____. "The Systems Analysis Approach to Industrial Arts Content." *Where the Action Is: Selected Addresses and Proceedings of the American Industrial Arts Association's Annual Convention* (31st, Las Vegas). Washington, D.C.: American Industrial Arts Association, 1969. pp. 83-93. (ED 038 544 MF $0.65 HC not available from EDRS) (a) **20**

_____ . "Systems, Concepts with Implications for Industrial and Technical Education." *Journal of Industrial Teacher Education,* Vol. 6 (Winter, 1969), pp. 5-19. (b) **20**

Young, Darius R. "Can Industrial Arts Teachers Change?" *The Journal of Industrial Arts Education,* Vol. 29 (Special Convention Issue, 1970), pp. 38-40. **39**

Ziel, H. R.; LeBlanc, D. R.; and Manuel, D. W. *Industrial Arts in General Education: Research Report I.* Edmonton, Alberta, Canada: University of Alberta, 1966. **13**